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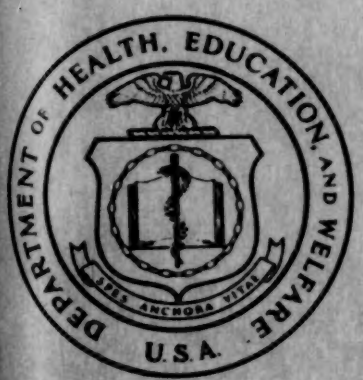
RADIOLOGICAL HEALTH DATA

MONTHLY REPORT

November 1960



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

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MONTHLY REPORT

NOVEMBER 1960

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

Division of Radiological Health

PREFACE

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned, among other things, primary responsibility within the Executive Branch for the collation, analysis, and interpretation of data on environmental radiation levels. Within the Department this responsibility has been delegated to the Division of Radiological Health, Public Health Service.

As a step in the discharge of this responsibility, the Public Health Service is publishing ***Radiological Health Data.*** This publication is issued monthly, with each third issue (starting July 1960) expanded into a quarterly report.

The monthly and quarterly reports are reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Commerce
Department of Agriculture

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SECTION I.—MILK

PUBLIC HEALTH SERVICE MILK MONITORING PROGRAM

The original Public Health Service Milk Monitoring Program consisted of 12 sampling stations. This has now been expanded to include an additional 60 stations. Since the sampling procedures for the original and the added stations are somewhat different, they will be described and reported separately. The Public Health Service Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, continues to conduct the analyses for the original network stations while the Public Health Service Southeastern Radiological Health Facility, Montgomery, Alabama, and the Southwestern Radiological Health Facility, Las Vegas, Nevada, provides this service for the added stations.

Original Stations

The initial purpose of establishing this network was in keeping with the normal and continuing program of the Department of Health, Education, and Welfare to determine trends in our changing environment, including measurement of amounts of radioactivity in water, air, milk, and other foods. Milk was the food chosen for initial testing since it is among the most important components of the diet and is available at all seasons of the year and in all climates. A primary objective of the project was to develop and simplify methods of collection and radiochemical analysis of milk to make them more suitable for larger scale programs. Since this program has been in operation for over three years, its contribution of information is significant.

The selection of the original sampling stations was based on the following criteria:

1. The milk represented in each sample was from a group of farms milking a total of at least 1,000 cows.

2. The number of individual farms was small enough so that collection of collateral field data from each farm was feasible.

3. The milk samples were from a supply that was part of a metropolitan milkshed.

4. The conditions under which the milk was received were such that each sample was representative of the same farms in the production area.

The Overton, Nevada and St. George, Utah milksheds do not fulfill the 1,000 cow minimum requirement but have been included since they are part of the monitoring program around the Nevada Test Site.

One gallon samples are collected once each month and forwarded by air parcel post to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for radionuclide analysis. It is estimated that these samples represent 2,000 gallon lots. The concentration of iodine-131, barium-140, and cesium-137 and naturally occurring potassium-40 are all currently being measured when present in the milk by gamma scintillation spectroscopy. Total strontium and strontium-90 are determined following radiochemical separations, and the strontium-90 is calculated by measuring the build-up in a two-week period of the daughter decay product, yttrium-90 using a low background anticoincidence beta counter. The total radioactive strontium is counted in a shielded internal proportional counter with the strontium-89 calculated as the difference.

Publication of the data will normally follow about four months after collection due to shipment, processing, decay product build-up, compilation of the data, and inclusion with other radiation data in the monthly reports.

A description of the program appears in "The Occurrence of Strontium-90, Iodine-131 and Other Radionuclides in Milk, May 1957 through April 1958," by J. E. Campbell, G. K. Murthy, A. S. Goldin, H. B. Robinson, C. P. Straub, F. J. Weber, and K. H. Lewis, American Journal of Public Health, Vol. 49, No. 2, Feb. 1959, American Public Health Association, reprinted by the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959.

April through September 1960 issues of Radiological Health Data list references for technical descriptions of the methodology of analyses used.

Table 1 presents the data for June for the original stations.

Added Stations

The Milk Montoring Program is being expanded for the primary purpose of providing additional information on levels of radiation in milk consumed by the public. The new stations are being established in cooperation with State and local health and milk sanitation agencies. The cities have been selected in order to provide adequate coverage from the combined viewpoints of production areas and consuming population. The emphasis on this expanded sampling and radioassay program is that of:

1. Measuring the levels of radionuclides in the milk consumed by the public in various regions of the country by obtaining samples of pasteurized and homogenized milk at the point of distribution to the public.

2. Providing one sampling point within each state with additional points when indicated by widely varying conditions of the milk supply or the need to provide coverage of large population groups. This differs from the original set of sampling stations whose selection was based principally upon certain criteria involving the milk production and milkshed area characteristics.

In some instances the designated points are the same as those which reported originally. The establishment of the added sampling stations does not preclude the need for further samples from the selected milksheds serving the same cities. It is important that both networks be in operation for a sufficient period of time to provide an overlap for purposes of comparative study.

The sampling procedure has been developed to give a sample from one day's sales per month in a community which will be as representative of the total supply as can be achieved under practical conditions. The sample will be a composite of those plants supplying not less than 90% of the city's milk supply. The contribution from each plant to the total sample will be approximately proportional to volume of milk sold.

The samples from the added stations are collected with the assistance of the various State and local health and milk sanitation agencies and shipped for analysis to either the Southwestern or Southeastern Radiological Health Facility. The Southeastern Radiological Health Facility processes samples from the 30 states generally east of the Mississippi, and the Southwestern Radiological Health Facility from the western states.

At the present time radioassays for Sr^{90} and Cs^{137} are being performed. As the laboratories increase their capacities and instrumentation, a selected group of radionuclides of concern to public health agencies will be included for assay as necessary for complete monitoring of the milk supply.

The data from the Southwestern Radiological Health Facility and the Southeastern Radiological Health Facility for June 1960 are presented in Table 2 and Table 3 respectively.

TABLE 1.–DATA ON RADIOACTIVITY IN MILK

Public Health Service Milk Monitoring Program
Robert A. Taft Sanitary Engineering Center

June 1960

(Radioactivity in $\mu\mu$c/liter)

Area	Calcium grams/liter		Iodine-131		Strontium-89		Strontium-90		Barium-140		Cesium-137	
	June	Yearly average	June	Yearly average	June	Yearly average	June	Yearly average	June	Yearly average	June	Yearly average
Atlanta, Ga.	1.04	1.13	0	3	0	5	12.0	15.5	0	0	35	60
Austin, Tex.	1.02	1.09	0	2	0	2	2.6	5.0	0	0	25	28
Chicago, Ill.	1.14	1.09	0	0	0	3	12.6	9.8	0	0	30	43
Chicinnati, Ohio	1.22	1.12	0	0	0	3	10.0	11.0	0	0	15	33
New York, N. Y.	1.11	1.07	0	1	0	2	9.3	10.1	0	0	20	41
Overton, Nev.	1.10	1.08	0	0	0	0	2.3	3.2	0	0	5	21
Sacramento, Calif.	1.17	1.09	0	0	0	<1	4.3	3.6	0	0	5	23
Salt Lake City, Utah	1.11	1.10	0	0	0	2	7.2	7.2	0	0	25	42
Spokane, Wash.	1.04	1.12	0	0	0	5	17.3	12.6	0	0	35	56
St. Louis, Mo.	1.18	1.23	0	0	0	6	18.1	20.8	0	0	30	49

Samples are taken at one sampling point from the milk supply of the areas listed above.

TABLE 2.--DATA ON RADIOACTIVITY IN MILK

Public Health Service Milk Monitoring Program
Southwestern Radiological Health Facility

June 1960

(Radioactivity in $\mu\mu$c/liter)

Area	Calcium grams/liter		Strontium-89		Strontium-90	
	June	Average to date	June	Average to date	June	Average to date
Albuquerque, New Mexico[4]	1.1	1.2	[5]0	0	5.6	4.1
Denver, Colorado[4]	1.1	1.2	0	0	7.3	7.6
Des Moines, Iowa[1]	1.1	-	0	-	8.2	-
Helena, Montana[1]	1.0	-	0	-	8.9	-
Honolulu, Hawaii[3]	1.1	1.1	0	1.6	3.4	3.5
Idaho Falls, Idaho[4]	1.0	1.0	0	2.2	7.4	6.0
Kansas City, Missouri[3]	1.0	1.1	0	6.4	9.4	8.2
Laramie, Wyoming[3]	1.1	1.1	0	2.0	5.3	5.7
Las Vegas, Nevada[3]	1.1	1.1	0	0	2.8	2.8
Palmer, Alaska[4]	1.1	1.1	0	0	7.5	6.8
Portland, Oregon[3]	1.1	1.1	0	5.8	9.7	11.0
Salt Lake City, Utah[4]	1.1	1.1	0	0	5.4	7.4
San Francisco, California[1]	1.1	-	0	-	7.3	-
Seattle, Washington[3]	1.1	1.1	0	5.4	12.2	9.8
Spokane, Washington[2]	1.0	1.1	0	0	10.0	10.4
Wichita, Kansas[3]	1.1	1.1	0	3.9	6.6	6.6

[1] Initial Sample.
[2] Average includes two months.
[3] Average includes three months.
[4] Average includes four months.
[5] Zero means calculated value is less than twice error at 95% confidence level.

TABLE 3.–DATA ON RADIOACTIVITY IN MILK

Public Health Service Milk Monitoring Program
Southeastern Radiological Health Facility

June 1960

(Radioactivity in $\mu\mu$c/liter)

Area	Calcium grams/liter		Strontium-90		Cesium-137	
	June	Yearly average	June	Yearly average	June	Yearly average
Austin, Tex.	1.16	-	2	-	20	-
Boston, Mass.	1.31	-	16	-	30	-
Buffalo, N. Y.	1.41	-	6	-	10	-
Burlington, Vt.	1.23	1.22	10	10	< 10	20
Charleston, W. Va.	1.26	1.21	11	9	< 10	10
Charlotte, N. C.	1.07	-	14	-	20	-
Dallas, Tex.	1.35	-	8	-	< 10	-
Hartford, Conn.	1.20	1.21	10	9	20	20
Louisville, Ky.	1.21	1.24	10	7	< 10	10
Manchester, N. H.	1.28	1.31	14	13	40	40
New York, N. Y.	1.24	-	11	-	20	-
Philadelphia, Pa.	1.25	-	10	-	30	-
Pittsburgh, Pa.	1.25	1.24	16	15	< 10	20
Portland, Maine	1.22	-	15	-	40	-
Providence, R. I.	1.29	-	18	-	20	-
Syracuse, N. Y.	1.36	1.28	8	7	< 10	20
Trenton, N. J.	1.26	-	10	-	20	0
Wilmington, Del.	1.26	-	10	-	40	-

Notes: Yearly average is average of April, May, and June values. Sr^{89} analysis performed, but no significant amounts detected.

DATA ON RADIOACTIVITY IN MILK

Atomic Energy Commission Health and Safety Laboratory

The Atomic Energy Commission Health and Safety Laboratory conducts a routine milk monitoring program at four locations in the United States. Data for January, February and March 1960 were given in the Radiological Health Data August issue for three of the locations and in the October 1960 issue for the fourth. A list of publications for previous data may be found in the April 1960 issue.

TABLE 1.—STRONTIUM-90 AND CALCIUM IN AEC MILK SAMPLES

Sampling station location	Strontium-90			Calcium	
	μμc/liter (fluid)	μμc/kg (powdered)	μμc/ gm Ca	gm/liter (fluid)	gm/kg (powdered)
Perry, N. Y.					
(Powdered milk)					
April		69.3	7.7		9.0
May		65.8	7.3		9.1
June		64.4	7.1		9.1
New York City					
(Liquid milk)					
April	9.3		8.7	1.1	
May	9.6		8.8	1.1	
June	11.0		10.1	1.1	
Mandan, S. Dak.					
(Powdered buttermilk)					
April		280	24.3		11.5
May		230	21.4		10.7
June		120	11.5		10.4
Honolulu, Hawaii					
(Liquid milk)					
April*	3.3		3.3	1.0	
	4.4		4.3	1.0	
May*	3.9		3.6	1.1	
	2.3		2.2	1.1	
June*	4.1		3.9	1.1	
	2.8		2.7	1.0	

*Two results per month represents milk from two different dairies.

SECRETION OF DIETARY STRONTIUM-90 AND CALCIUM IN HUMAN MILK *

Dr. S. Allan Lough, Director of the Atomic Energy Commission's Health and Safety Laboratory initiated a study in May 1959 on the secretion of strontium-90 in human milk. The five participants in the study were fed a known diet starting immediately postpartum. After a conditioning period of about 20 days, a five-day collection of food equivalent to that eaten, and a five-day collection of milk were obtained for analyses. The analyses for strontium-90 and calcium were conducted at the Health and Safety Laboratory and the data for the individual subjects are shown in Table 1.

The authors noted that subject 1 had an exceptionally high value of μμc Sr^{90}/gm Ca in her diet. This was apparently due to her large consumption of non-milk foods with a low calcium content.

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*Abstract from "Secretion of Dietary Strontium-90 and Calcium in Human Milk," S. Allan Lough, Gerald H. Hamada and C. L. Comar, Proceedings of the Society for Experimental Biology and Medicine, 1960, Vol. 104, page 194-198.

TABLE 1.--RESULTS ON HUMAN DIET AND MILK STUDY

Subjects:	I	II	III	IV	V
	Food Eaten				
1. Total wt eaten (gm)	14,780	13,800	15,390	12,380	13,220
2. Total ash (gm)	148.29	117.55	121.89	125.23	115.49
3. Ca as percent of total wt	0.03	0.06	0.07	0.06	0.05
4. gm Ca in 5-day sample	4.97	8.65	10.41	7.35	7.23
5. $\mu\mu$c Sr^{90} in 5-day sample	150.1 $\pm$ 4.3 *	127.9 $\pm$ 4.0	126.6 $\pm$ 3.4	138.9 $\pm$ 7.8	106.0 $\pm$ 1.7
6. $\mu\mu$c Sr^{90}/gm Ca	30.20 $\pm$ 0.76	14.79 $\pm$ 0.09	12.16 $\pm$ 0.25	18.90 $\pm$ 1.06	14.66 $\pm$ 0.99
	Milk Secreted				
7. Total weight (gm)	7,146	3,129	4,246	4,069	7,233
8. Total volume (ml)	6,930	3,030	4,140	3,940	7,000
9. Total ash (gm)	14.22	6.27	9.54	8.92	14.95
10. Ca as percent of total wt	0.023	0.023	0.023	0.027	0.028
11. $\mu\mu$c Sr^{90}/kg milk	0.19 $\pm$ 0.05 **	0.44 $\pm$ 0.16	0.23 $\pm$ 0.04	0.50 $\pm$ 0.10	0.36 $\pm$ 0.06
12. gm Ca in 5-day sample	1.640	0.709	0.985	1.088	2.018
13. $\mu\mu$c Sr^{90} in 5-day sample	1.36 $\pm$ 0.38	1.38 $\pm$ 0.51	1.01 $\pm$ 0.17	2.04 $\pm$ 0.40	2.59 $\pm$ 0.46
14. $\mu\mu$c Sr^{90}/gm Ca	0.83 $\pm$ 0.23	1.95 $\pm$ 0.72	1.03 $\pm$ 0.16	1.88 $\pm$ 0.37	1.28 $\pm$ 0.22
	Relation Between Food Eaten and Milk Secreted				
15. Ratio Sr^{90}/Ca Milk to Sr^{90}/Ca Diet	0.028	0.132	0.085	0.100	0.087

* Error term is one standard deviation from the mean of duplicate analyses.
** Error term is one standard deviation due to counting.

SECTION II.—AIR

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in environmental radiation due to radioactive fallout from nuclear weapons tests. Although no nuclear tests have been conducted by the United States since 1958, the program has proven sufficiently valuable that it has been extended to a round-the-year basis and currently consists of 45 stations at urban locations (see figure 1) operated by State and local health department personnel with 2 operated by U. S. Public Health Service personnel.

Measurements of gross beta radioactivity in air have been taken since they provide one of the earliest and most sensitive indications of increases of activity in the environment, and thus act as an "alert" system. A direct evaluation of biological hazards is not possible from these data alone. However, field measurements do enable the operator to estimate the amount of beta activity of particulates in the air at the station five hours after collection, by comparison to a known source, using a portable survey meter. The filters are then forwarded to a laboratory in Washington for a more refined measurement using a thin window proportional counter.

Air samplers are in operation at the 45 stations on an average of 70% of the week. Air is drawn through a cellulose carbon loaded dust filter using a high volume air sampler. The radioactive material in fallout adhering to small dust-like particles is retained on the filter. Some gaseous fission products are adsorbed by the carbon. The contribution by gaseous fission products has represented only a small part of the total beta activity in these samples.

About 85% of the stations collect samples of precipitation which are sent to Washington for analysis. Values are now below limits of detection by present instrumentation. New equipment is being procured to measure lower values. Measurements have indicated that the bulk of deposited activity occurs through precipitation but concentrations in surface air are not directly relatable to the amount deposited through precipitation.

Table 1 presents a summary of the data for June 1960.

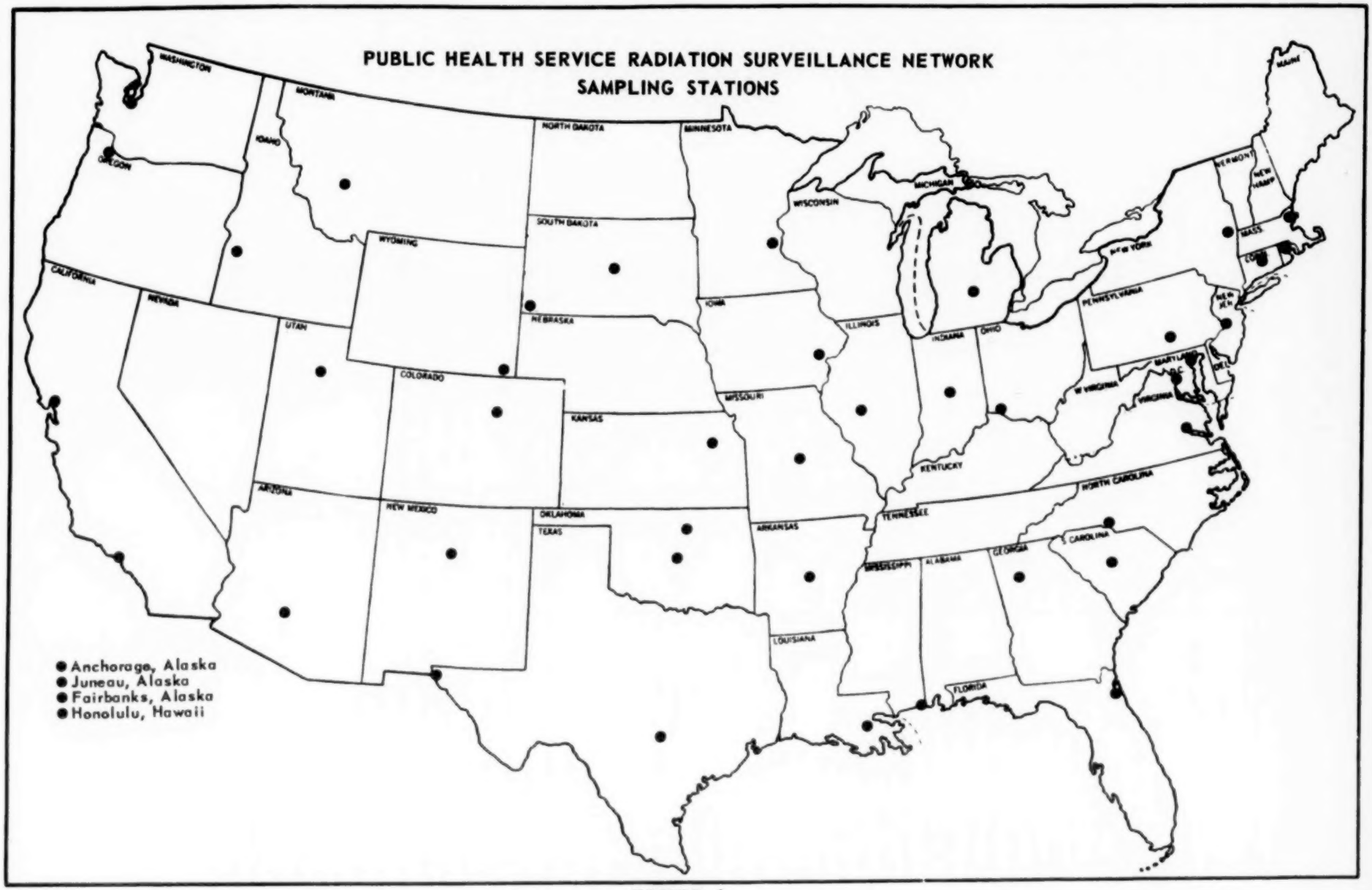

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK
SAMPLING STATIONS
WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
ARIZONA
COLORADO
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S. CAROLINA
NORTH CAROLINA
VIRGINIA
W. VIRGINIA
PENNSYLVANIA
NEW YORK
MARYLAND
D.C.
DEL.
N.J.
VERMONT
N.H.
MAINE
MASS.
Anchorage, Alaska
Juneau, Alaska
Fairbanks, Alaska
Honolulu, Hawaii

FIGURE 1

TABLE 1.—RADIOACTIVITY OF PARTICULATES IN AIR-GROSS BETA COUNTS

Public Health Service Radiation Surveillance Network

June 1960

Station location	Weighted average $\mu\mu c/m^3$	Maximum $\mu\mu c/m^3$	Minimum $\mu\mu c/m^3$
Alaska, Anchorage	< 0.11	0.17	< 0.10
Alaska, Fairbanks	< 0.14	0.23	< 0.10
Alaska, Juneau	< 0.10	0.16	< 0.10
Arizona, Phoenix	0.24	0.41	0.15
Arkansas, Little Rock	< 0.17	0.26	< 0.10
California, Berkeley	< 0.10	0.18	< 0.10
California, Los Angeles	< 0.10	0.11	< 0.10
Colorado, Denver	< 0.14	0.26	< 0.10
Connecticut, Hartford	< 0.15	0.30	< 0.10
District of Columbia	< 0.22	0.66	< 0.10
Florida, Jacksonville	< 0.15	0.32	< 0.10
Georgia, Atlanta	< 0.21	0.44	< 0.10
Hawaii, Honolulu	< 0.10	< 0.10	< 0.10
Idaho, Boise	0.21	0.34	0.12
Illinois, Springfield	< 0.21	0.42	< 0.10
Indiana, Indianapolis	< 0.16	0.31	< 0.10
Iowa, Iowa City	< 0.14	0.26	< 0.10
Kansas, Topeka	< 0.12	0.22	< 0.10
Louisiana, New Orleans	0.23	0.33	0.12
Maryland, Baltimore	< 0.18	0.26	< 0.10
Massachusetts, Lawrence	< 0.12	0.16	< 0.10
Michigan, Lansing	< 0.18	0.36	< 0.10
Minnesota, Minneapolis	< 0.16	0.29	< 0.10
Mississippi, Pascagoula	< 0.20	0.45	< 0.10
Missouri, Jefferson City	< 0.15	0.36	< 0.10
Montana, Helena	< 0.16	0.27	< 0.10
New Jersey, Trenton	< 0.22	0.33	< 0.10
New Mexico, Santa Fe	< 0.18	0.27	< 0.10
New York, Albany	< 0.14	0.28	< 0.10
North Carolina, Gastonia	< 0.19	0.29	< 0.10
Ohio, Cincinnati	0.85	2.30	0.30
Oklahoma, Oklahoma City	< 0.17	0.36	< 0.10
Oklahoma, Ponca City	< 0.10	0.14	< 0.10
Oregon, Portland	< 0.12	0.26	< 0.10
Pennsylvania, Harrisburg	< 0.20	0.41	< 0.10
Rhode Island, Providence	< 0.17	0.28	< 0.10
South Carolina, Columbia	< 0.18	0.34	< 0.10
South Dakota, Edgemont	-	-	-
South Dakota, Pierre	< 0.20	0.34	< 0.10
Texas, Austin	< 0.14	0.25	< 0.10
Texas, El Paso	0.21	0.25	0.13
Utah, Salt Lake City	< 0.17	0.28	< 0.10
Virginia, Richmond	< 0.14	0.23	< 0.10
Washington, Seattle	< 0.11	0.19	< 0.10
Wyoming, Cheyenne	< 0.14	0.23	< 0.10

TABLE 2.--RADON AND THORON MEASUREMENTS

Public Health Service Radiation Surveillance Network
Cincinnati, Ohio

June 1960

Date	Continuous sample collection			Radon[a] PM $\mu\mu c/m^3$	Radon[b] AM $\mu\mu c/m^3$	Thoron[c] $\mu\mu c/m^3$	Beta[d] activity $\mu\mu c/m^3$
	Sample change time	Sampling period (hours)	Volume m^3				
June 1	0812	24.0	28.7	72	530	5.0	1.7
2	0815	24.0	28.4	136	296	5.4	1.9
3	0808	23.8	28.3	110	200	2.8	0.3 (3)
6	0810	71.9	84.1	57	213	5.5	0.7
7	0811	24.0	28.7	63	374	6.6	2.3
8	0805	23.8	27.3	76	271	4.1	1.4
9	0812	24.0	28.9	91	277	4.0	1.5
10	0815	24.0	28.8	128	682	8.9	0.8 (3)
13	0811	71.9	85.4	147	182	3.2	0.3
14	0815	24.0	28.7	109	116	0.7	0.6
15	0807	23.8	28.6	43	72	0.9	0.5
16	0805	24.0	28.5	91	297	2.3	1.0
17	0807	24.1	28.8	81	212	0.9	0.3 (3)
20	0807	71.9	86.7	160	272	4.4	0.5
21	0810	24.0	28.9	158	247	3.5	1.3
22	0820	24.1	28.3	234	518	4.3	1.5
23	0810	23.8	28.7	40	46	0.7	0.5
24	0812	24.0	28.9	92	112	0.9	0.3 (3)
27	0810	71.9	85.0	131	643	7.3	1.0
28	0810	23.9	28.8	61	178	1.9	0.6
29	0810	23.9	28.5	70	144	1.1	0.3
30	0825	24.2	28.7	257	169	3.7	1.1
	Average.....			108	282	3.5	0.8

(a) Filters are temporarily withdrawn from sampler at about 3 PM and counted. (Values are corrected back to removal time.) The filters are then replaced on sampler to complete the sampling period of about 24 hours. Thus, the values in this column are from the same filters that are counted at about 8 AM the following day.

(b) Measured within a few minutes of removal of filter from sampler and corrected back to collection time (uncorrected for thoron daughter interference).

(c) Thoron from alpha activity of filter sample counted 7 hours after taking a 24-96 hour sample.

(d) Gross beta activity when counted one day after end of sampling or later as indicated by numeral in parenthesis.

PUBLIC HEALTH SERVICE NATIONAL AIR SAMPLING NETWORK

The Public Health Service developed its National Air Sampling Network to secure basic data on the nature and extent of air pollution throughout the United States, and to detect trends in levels of pollution with respect to time, location, population density, climate, and other factors associated with air quality.

The current basic Network, which is operated by the PHS Division of Air Pollution, consists of 103 sampling stations operating every year, of which 66 are in large cities and 37 are in nonurban areas. In addition to these every year stations, 126 cities have stations which operate every other year. Thus, there are 229 sampling stations in all, of which about 166 are active in any given year. A list of National Air Sampling Network Stations appeared in the May 1960 issue of Radiological Health Data.

The Network stations are manned by cooperating federal, state, and local agencies. Twenty-four hour samples of suspended particulate matter representing approximately 2,000 cubic meters of air are collected on glass fiber filters on a bi-weekly random sampling schedule. The analyses of these samples include the measurement of total quantity of suspended particulate matter, the organic matter soluble in benzene, and gross beta radioactivity. Selected samples are analyzed also for nitrates and sulfates, and for a number of metals.

Quarterly reports of individual sample data and annual summaries are distributed to all participating agencies and state health departments. A comprehensive report on the first five years of operation of the Network is contained in the publication, Air Pollution Measurements of the National Air Sampling Network, Public Health Service Publication No. 637, 1958; for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., price $2.00. Gross beta activity, by States, for the years 1953 through 1958 was submitted by Dr. F. J. Weber, Chief of the Division of Radiological Health Public Health Service, in testimony before the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 173-185.

The 1959 quarterly and yearly averages of the gross beta activity of particulates in air were published in the October 1960 Radiological Health Data. Table 1 presents the data for the first two quarters of 1960.

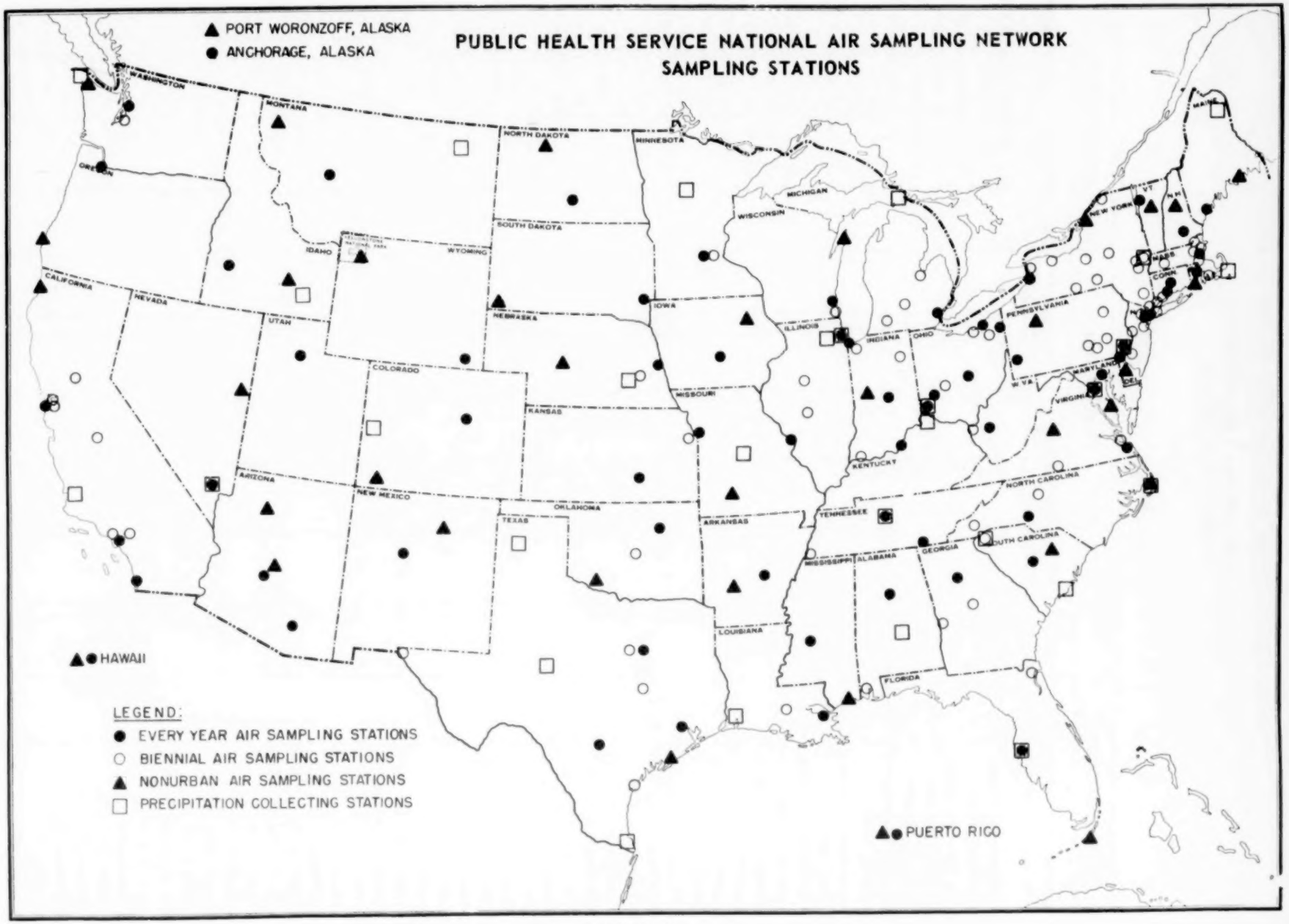

PUBLIC HEALTH SERVICE NATIONAL AIR SAMPLING NETWORK
SAMPLING STATIONS
PORT WORONZOFF, ALASKA
ANCHORAGE, ALASKA
HAWAII
PUERTO RICO
LEGEND:
EVERY YEAR AIR SAMPLING STATIONS
BIENNIAL AIR SAMPLING STATIONS
NONURBAN AIR SAMPLING STATIONS
PRECIPITATION COLLECTING STATIONS
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
WYOMING
SOUTH DAKOTA
MICHIGAN
WISCONSIN
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
KANSAS
MISSOURI
KENTUCKY
ARIZONA
NEW MEXICO
OKLAHOMA
TEXAS
ARKANSAS
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
MISSISSIPPI
ALABAMA
GEORGIA
LOUISIANA
FLORIDA

FIGURE 1

TABLE 1.--GROSS BETA RADIOACTIVITY IN AIR

National Air Sampling Network
Public Health Service

1960

(picocuries per cubic meter)

Station	First quarter		Second quarter	
	No. samples	Average**	No. samples	Average**
Bridgeport, Conn.	6	0.1	6	0.1
Hartford, Conn.	7	0.1	6	0.1
New Haven, Conn.	7	0.1	6	0.1
Stamford, Conn.	7	0.1	6	0.2
Portland, Maine	5	0.1	7	0.1
*Acadia National Park, Maine	7	0.1	6	0.1
Boston, Mass.	7	0.1	6	0.1
Lawrence, Mass.	7	0.1	6	0.1
Lynn, Mass.	6	0.1	7	0.1
Fall River, Mass.	5	0.1	3	0.1
Quincy, Mass.	7	0.1	5	0.2
Springfield, Mass.	2	0.1	6	0.1
Somerville, Mass.	7		6	0.1
Manchester, N. H.	6		6	0.1
*Coos County, N. H.	6	0.1	6	0.1
Providence, R. I.	7	0.1	6	0.1
*Washington County, R. I.	7	0.1	6	0.1
Burlington, Vt.	5	0.1	7	0.1
*Orange County, Vt.	5		7	0.1
Wilmington, Del.	6	0.1	6	0.2
*Kent County, Del.	1	0.2	7	0.1
Elizabeth, N. J.	4	0.1	7	0.1
Camden, N. J.	7	0.1	6	0.1
Trenton, N. J.	4	0.1	4	0.2
East Orange, N. J.	5	0.1	4	0.1
Newark, N. J.	7	0.1	6	0.1
New York, N. Y.	7	0.1	5	0.1
Binghamton, N. Y.	5	0.1	6	0.1
Albany, N. Y.	5	0.1	8	
Schenectady, N. Y.	7	0.1	5	0.1
Syracuse, N. Y.	6	0.1	7	0.1
Utica, N. Y.	7		6	0.1
Rochester, N. Y.	7	0.1	6	0.1
Niagara Falls, N. Y.	5	0.1	5	0.1
New Rochelle, N. Y.	6	0.1	7	0.1
Troy, N. Y.	6	0.1	4	0.1
Massena, N. Y.	7		5	0.1
Glen Cove, N. Y.	7	0.1	5	
Elmira, N. Y.	7	0.1	6	0.1
Mt. Vernon, N. Y.	1	0.1	6	0.1
*Cape Vincent, N. Y.	3	0.1	6	0.1
Philadelphia, Pa.	6		7	0.1
Pittsburgh, Pa.	7	0.1	4	0.1
Lancaster, Pa.	2	0.1	4	0.1
Harrisburg, Pa.	6	0.1	6	0.1
Reading, Pa.	6	0.1	7	0.1
Wilkes-Barre, Pa.	7	0.1	6	0.1
*Clarion County, Pa.	7	0.1	6	0.1
Washington, D. C.	5	0.2	6	0.2
Louisville, Ky.	4	0.2	2	0.1
Baltimore, Md.	7	0.1	5	0.2

1 picocurie = 1 micromicrocurie.

TABLE 1.--GROSS BETA RADIOACTIVITY IN AIR--Con.

National Air Sampling Network
Public Health Service

1960

(picocuries per cubic meter)

Station	First quarter		Second quarter	
	No. samples	Average **	No. samples	Average**
* Calvert County, Md.	7	0.1	6	0.1
Charlotte, N. C.	6	0.1	7	0.2
Winston-Salem, N. C.	7	0.2	6	0.2
Ashville, N. C.	7	0.2	6	0.2
* Cape Hatteras, N. C.	6	0.1	5	0.1
San Juan, P. R.	3	0.5	7	0.1
* Loquillo Mtns. Pk., P. R.	6	0.1	6	0.1
Norfolk, Va.	6	0.1	7	
Hampton, Va.	7	0.1	6	0.2
Danville, Va.	7	0.1	6	0.2
* Shenandoah National Park, Va.	7	0.1	6	0.2
Charleston, W. Va.	7	0.1	6	0.2
Huntington, W. Va.	6	0.1	5	0.1
Birmingham, Ala.	6	0.1	6	0.2
Mobile, Ala.	7	0.1	5	0.1
Tampa, Fla.	7	0.3	6	0.2
Jacksonville, Fla.	7	0.2	6	0.2
* Florida Keys, Fla.	5	0.1	7	0.1
Atlanta, Ga.	7	0.2	6	0.1
Columbus, Ga.	7	0.2	6	0.2
Macon, Ga.	7	0.1	6	0.1
Jackson, Miss.	6	0.1	6	0.2
* Jackson County, Miss.	7	0.1	6	0.1
Columbia, S. C.	6	0.1	7	0.2
Greenville, S. C.	6	0.2	6	0.2
* Richland County, S. C.	6	0.1	7	0.2
Chattanooga, Tenn.	7	0.1	6	0.2
Nashville, Tenn.	6	0.2	7	0.1
Memphis, Tenn.	7	0.1	6	0.2
Chicago, Ill.	5	0.1	4	0.1
Springfield, Ill.	4	0.2	4	0.1
Peoria, Ill.	4	0.1	5	0.2
East Chicago, Ind.	7	0.1	5	0.1
Evansville, Ind.	7	0.2	6	0.2
Fort Wayne, Ind.	7		6	0.1
Indianapolis, Ind.	6	0.1	7	0.2
Gary, Ind.	6	0.1	6	0.1
* Montgomery County, Ind.	7	0.1	6	0.1
Detroit, Mich.	7	0.1	6	0.1
Kalamazoo, Mich.	6	0.1	7	0.1
Lansing, Mich.	6		6	
Saginaw, Mich.	6	0.1	7	0.1
Cincinnati, Ohio	7	0.1	5	0.1
Youngstown, Ohio	7	0.1	6	0.1
Cleveland, Ohio	6	0.1	7	0.1
Columbus, Ohio	6	0.1	6	0.1
Lorain, Ohio	7	0.1	6	0.1
Akron, Ohio	7	0.1	6	0.1
Dayton, Ohio	7	0.1	6	0.1
Springfield, Ohio	6	0.1	7	0.1
Milwaukee, Wis.	6	0.1	6	0.1

1 picocurie = 1 micromicrocurie.

TABLE 1.--GROSS BETA RADIOACTIVITY IN AIR--Con.

National Air Sampling Network
Public Health Service

1960

(picocuries per cubic meter)

Station	First quarter		Second quarter	
	No. samples	Average **	No. samples	Average **
Racine, Wis.	6	0.1	6	0.1
* Door County, Wis.	6	0.1	7	0.1
Des Moines, Iowa	7	0.2	5	0.2
* Clayton County, Iowa	7	0.1	6	0.1
Kansas City, Kansas	7	0.1	6	0.1
Wichita, Kansas	5	0.1	6	0.3
Minneapolis, Minn.	7	0.1	6	0.1
St. Paul, Minn.	7	0.1	5	0.1
Kansas City, Mo.	7	0.1	6	0.1
St. Louis, Mo.	7	0.1	6	0.2
* Shannon County, Mo.	4	0.1	3	0.2
Omaha, Nebr.	7	0.1	6	0.1
Lincoln, Nebr.	7	0.1	7	0.1
* Thomas County, Nebr.	6	0.1	7	0.2
Bismarck, N. D.	5		7	0.1
* Ward County, N. D.	5	0.1	5	0.1
Sioux Falls, S. D.	4	0.1	6	0.2
* Black Hills Forest, S. D.	5	0.1	6	0.1
Little Rock, Ark.	7	0.1	6	0.2
* Montgomery County, Ark.	7	0.1	6	0.2
New Orleans, La.	7	0.1	6	0.1
Baton Rouge, La.	7	0.2	6	0.2
Alburquerque, N. Mex.	6	0.2	6	0.2
* Colfax County, N. Mex.	6	0.1	5	0.1
Tulsa, Okla.			7	0.2
Oklahoma City, Okla.	6	0.1	4	0.2
* Cherokee County, Okla.	6	0.2	5	0.2
Ft. Worth, Texas	6	0.1	7	0.2
Houston, Texas	7	0.2	6	0.2
Dallas, Texas	7	0.1	5	0.2
San Antonio, Texas	6	0.2	6	0.1
El Paso, Texas	7	0.3	6	0.2
Corpus Christi, Texas	7	0.1	6	0.2
Waco, Texas	7	0.1	6	0.1
* Calhoun County, Texas	5	0.1	2	0.2
Denver, Colo.	7	0.1	6	0.2
* Montezuma County, Colo.	7	0.3	5	0.3
Boise, Idaho	7	0.3	5	0.1
* Butte County, Idaho	6	0.1	6	0.1
Helena, Mont.	6	0.1	6	0.1
* Glacier National Park, Mont.	6	0.1	6	0.1
Salt Lake City, Utah	6	0.3	6	0.2
Cheyenne, Wyo.	6	0.1	7	0.1
* Yellowstone Park, Wyo.	4	0.1	3	0.2
Anchorage, Alaska	7	0.1	6	
* Pt. Woronzof, Alaska	6	0.1	7	0.1
Phoenix, Ariz.	7	0.2	5	0.2
Tucson, Ariz.	6	0.5	7	0.3
* Maricopa County, Ariz.	7	0.2	6	0.3
* Grand Canyon Park, Ariz.	4	0.2	7	0.2
Los Angeles, Calif.	6	0.2	7	0.1

1 picocurie = 1 micromicrocurie.

TABLE 1.--GROSS BETA RADIOACTIVITY IN AIR--Con.

National Air Sampling Network
Public Health Service

1960

(picocuries per cubic meter)

Station	First quarter		Second quarter	
	No. samples	Average**	No. samples	Average**
San Francisco, Calif.	7	0.1	6	0.1
Pasadena, Calif.	7	0.1	6	0.1
San Diego, Calif.	7	0.2	6	
Burbank, Calif.	6	0.3	7	0.1
Fresno, Calif.	7	0.2	6	0.2
Oakland, Calif.	6	0.1	6	
Sacramento, Calif.	6	0.3	7	0.1
Richmond, Calif.	5	0.3	6	0.2
* Humboldt County, Calif.	6	0.1	5	
Honolulu, Hawaii	7	0.1	6	0.1
* Ewa County, Hawaii	6	0.2	7	
Las Vegas, Nevada	3	0.3	6	0.3
* White Pine County, Nevada	7	0.2	6	0.2
Portland, Oregon	7	0.1	6	
* Curry County, Oregon	7	0.1	5	0.1
Seattle, Washington	3	0.1		
Tacoma, Washington	3	0.2	5	
* Clallam County, Washington			3	

* Nonurban station.

** A blank space in the table indicates that the level was below the minimum detectable value of 0.1 pc/m^3.

GROSS BETA RADIOACTIVITY IN PRECIPITATION

National Air Sampling Network
Precipitation Collection Section
Public Health Service

During 1959 a precipitation collection and analysis program was established by the Weather Bureau Research Station in Cincinnati, Ohio, and the National Air Sampling Network. The collection stations are located at Weather Bureau Offices or Airport Stations. Monthly composite samples of precipitation are collected at 29 stations and forwarded to the Network laboratory for analysis. A list of these precipitation collection stations is given below. Samples are analyzed for total solids and a large number of metals and nonmetals. In addition, samples representing 85% or more of the official rainfall recorded at the collecting stations are analyzed for gross beta radioactivity if a large enough volume remains after the needs for the chemical analysis have been met.

Quarterly data on gross beta radioactivity of precipitation will be published in the Radiological Health Data Quarterly Reports. Tables 1 presents the data for the first two quarters of 1960.

PRECIPITATION COLLECTION STATIONS

National Air Sampling Network

Alabama: Montgomery
California: Santa Marie
Colorado: Grand Junction
Florida: Tampa
Idaho: Pocatello
Illinois:
  Chicago (Midway Airport)
  Chicago (O'Hare Airport)
Louisiana: Lake Charles
Maine: Caribou
Maryland: Silver Hill
Massachusetts: Nantucket
Michigan: Sault Ste. Marie
Minnesota: St. Cloud
Missouri: Columbia
Montana: Glasgow
Nebraska: Grand Island
Nevada: Las Vegas
New York: Albany
North Carolina: Cape Hatteras
Ohio:
  Cincinnati (Research Station)
  Cincinnati (Airport)
Pennsylvania: Philadelphia
South Carolina:
  Carleston
  Greenville
Tennessee: Nashville
Texas:
  Brownsville
  San Angelo
  Amarillo
Washington: Tatoosh Island

TABLE 1.--GROSS BETA RADIOACTIVITY OF PRECIPITATION

National Air Sampling Network
Public Health Service

First and second quarter 1960

Station location	January		February		March		April		May		June	
	pc/l	pc/m^2	pc/l	pc/m^2	pc/l	pc/m^2	pc/l	pc/m^2	pc/l	pc/m^2	pc/l	pc/m^2
Albany, New York	-	-	-	-	-	-	-	-	-	-	24	1,500
Brownsville, Texas	-	-	-	-	-	-	-	-	-	-	34	2,500
Cape Hatteras, N.C.	3	500	-	-	35	4,500	12	1,500	-	-	20	3,300
Caribou, Maine	-	-	9	800	26	1,600	-	-	28	2,200	-	-
Charleston, W. Va.	-	-	42	4,200	-	-	-	-	-	-	25	2,800
Chicago, Illinois (Midway Airport)	19	1,500	-	-	-	-	-	-	-	-	-	-
Chicago, Illinois (O'Hare Airport)	16	1,300	-	-	-	-	-	-	-	-	-	-
Cincinnati, Ohio (Airport)	13	700	-	-	-	-	-	-	41	3,300	-	-
Cincinnati, Ohio (WBRS)	-	-	-	-	-	-	-	-	-	-	41	5,200
Columbia, Missouri	12	400	-	-	-	-	-	-	-	-	12	1,000
Grand Island, Nebr.	-	-	-	-	-	-	39	2,600	-	-	-	-
Lake Charles, La.	-	-	-	-	-	-	47	7,500	-	-	-	-
Montgomery, Ala.	-	-	24	2,100	33	4,200	-	-	14	1,100	-	-
Nashville, Tenn.	-	-	-	-	-	-	35	2,600	51	3,600	31	7,800
Philadelphia, Penna.	-	-	-	-	-	-	-	-	65	5,200	-	-
Sault Ste. Marie, Mich.	-	-	-	-	-	-	-	-	36	5,000	-	-
Tampa, Florida	-	-	39	3,200	44	11,100	-	-	-	-	-	-
Washington, D.C.	37	2,200	-	-	-	-	33	2,500	38	4,200	-	-

pc = picocuries = micromicrocuries.
- No data available due to low counting efficiency or inadequate sample.

U. S. NAVAL RESEARCH LABORATORY RADIOACTIVITY MEASUREMENTS

Radioactivity measurements of air-filter samples collected at various sites along the 80th Meridian (West) are made by the U. S. Naval Research Laboratory under a program partially financed by the Atomic Energy Commission.

The daily record of fission product beta activity during June 1960 is shown in Table 1, while the radioactivity profile for the same month is shown in Figure 1. All radioactivity concentrations are given in disintegrations per minute per cubic meter of air at the collecting site. (2.2 disintegrations per minute per cubic meter equals 1 micromicrocurie per cubic meter)

TABLE 1.—DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION

U.S. Naval Research Laboratory

June 1960

(Disintegrations/minute per cubic meter of air)

Day	Punta Arenas, Chile	Puerto Montt, Chile	Santiago, Chile	Antofagasta, Chile	Chacaltaya, Bolivia	Lima, Peru	Guayaquil, Ecuador
1	-	0.04	0.13	0.07	0.05	0.06	0.03
2	-	0.03	0.08	0.07	0.05	0.06	0.07
3	-	0.03	0.08	0.07	0.05	0.06	0.07
4	-	0.04	0.11	0.08	0.04	0.02	0.07
5	-	0.04	0.11	0.08	0.04	0.02	0.06
6	-	0.04	0.11	0.08	0.04	0.02	0.06
7	-	0.02	0.09	0.08	0.05	0.04	0.07
8	-	0.02	0.09	0.08	0.05	0.04	0.05
9	-	0.02	0.06	0.07	0.05	0.06	0.04
10	-	0.01	0.06	0.07	0.05	0.06	0.04
11	-	0.01	0.10	0.05	0.06	0.04	0.04
12	-	0.07	0.10	0.05	0.06	0.04	0.04
13	-	0.07	0.10	0.05	0.06	0.04	0.07
14	-	0.03	0.07	0.08	0.04	0.03	0.08
15	-	0.03	0.07	0.08	0.04	0.03	0.08
16	-	0.03	0.07	0.07	0.05	0.03	0.07
17	-	0.03	0.07	0.07	0.05	0.03	0.07
18	-	0.03	0.06	0.05	0.06	0.01	0.04
19	-	0.01	0.06	0.05	0.06	0.01	0.04
20	-	0.01	0.06	0.05	0.06	0.01	0.04
21	-	0.07	0.06	0.05	0.03	0.03	0.04
22	-	0.07	0.06	0.05	0.03	0.03	0.07
23	-	0.06	0.02	0.02	0.03	0.06	0.04
24	-	0.06	0.02	0.02	0.03	0.06	0.04
25	-	0.01	0.06	0.10	0.03	0.03	0.04
26	-	0.01	0.06	0.10	0.03	0.03	0.04
27	-	0.01	0.06	0.10	0.03	0.03	0.05
28	-	0.03	0.07	0.13	0.03	0.02	0.06
29	-	0.03	0.07	0.13	0.03	0.02	0.06
30	-	0.02	0.07	0.07	0.05	0.02	0.03
Mean value	-	0.03	0.07	0.07	0.04	0.03	0.05

TABLE 1.—DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION—Con.

U.S. Naval Research Laboratory

June 1960

(Disintegrations/minute per cubic meter of air)

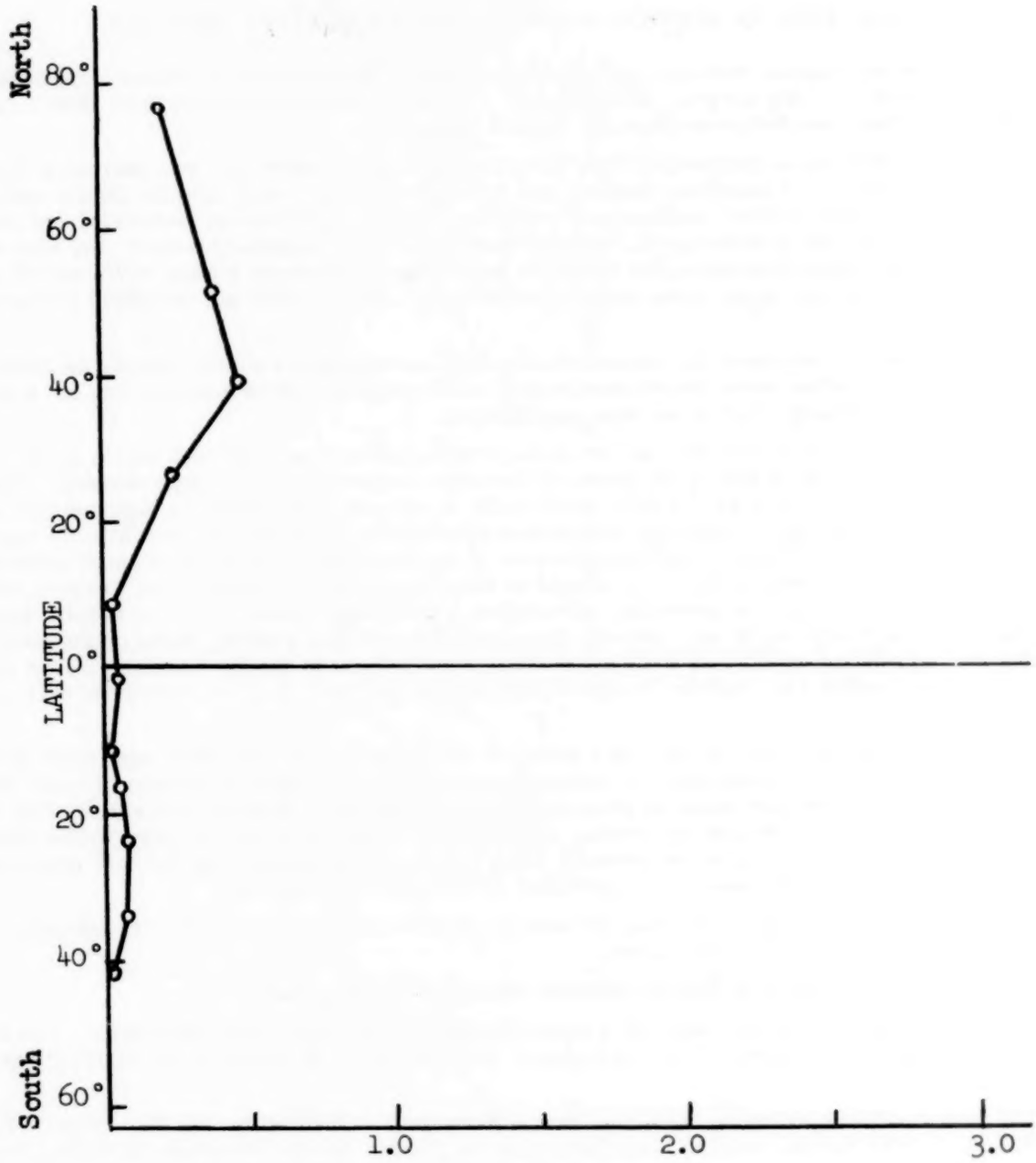
Day	Miraflores, Panama Canal	Mauna Loa, Hawaii	Miami, Florida	Washington, D. C.	Moosonee, Ontario, Canada	Thule, Greenland	Bravo*, Arctic Ice Floe
1	0.03	0.36	0.14	0.50	0.25	0.25	-
2	0.01	0.20	0.11	0.76	0.45	0.56	-
3	0.01	0.20	0.11	0.76	0.45	0.56	-
4	0.01	0.03	0.10	0.36	0.24	0.41	-
5	0.01	0.03	0.10	0.36	0.24	0.41	-
6	0.01	0.03	0.10	0.36	0.24	0.41	-
7	0.02	0.17	0.10	0.42	0.26	0.06	-
8	0.02	0.17	0.10	0.42	0.26	0.06	-
9	0.01	0.12	0.06	0.73	0.53	0.08	-
10	0.01	0.12	0.06	0.73	0.53	0.08	-
11	0.03	0.33	0.83	0.47	0.20	0.36	-
12	0.03	0.33	0.83	0.47	0.20	0.36	-
13	0.03	0.33	0.83	0.47	0.20	0.36	-
14	0.07	0.34	0.43	0.35	0.62	0.36	-
15	0.07	0.34	0.43	0.35	0.62	0.12	-
16	0.05	0.32	0.12	0.49	0.14	0.12	-
17	0.05	0.32	0.12	0.49	0.14	0.12	-
18	0.03	0.32	0.12	0.35	0.47	0.12	-
19	0.03	0.32	0.12	0.35	0.47	0.14	-
20	0.03	0.32	0.12	0.35	0.47	0.14	-
21	0.05	0.35	0.17	0.39	0.35	0.08	-
22	0.05	0.35	0.17	0.39	0.35	0.08	-
23	0.05	0.08	0.22	0.30	0.41	0.08	-
24	0.05	0.08	0.22	0.30	0.41	0.08	-
25	0.03	0.21	0.30	0.59	0.47	0.10	-
26	0.03	0.21	0.30	0.59	0.47	0.10	-
27	0.03	0.21	0.30	0.59	0.47	0.10	-
28	0.03	0.18	0.25	0.65	0.50	0.15	-
29	0.03	0.18	0.25	0.65	0.50	0.15	-
30	0.04	0.64	0.22	0.50	0.34	-	-
Mean value	0.03	0.24	0.24	0.48	0.38	0.21	-

* No sample received.

AVERAGE MEASUREMENTS OF SURFACE AIR
AT STATIONS ALONG THE 80TH MERIDIAN (WEST)

U. S. Naval Research Laboratory

June 1960



AVERAGE FISSION PRODUCT β-ACTIVITY
In d/m Per Cubic Meter of Air

FIGURE 1

SECTION III.—WATER

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK

The National Water Quality Network was established under the provision of Section 4 (c) of Public Law 660, which states ". . . the Surgeon General shall . . . collect and disseminate basic data . . . (relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and local health agencies, was started in October 1957. At present there are 75 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial and other uses; some of these stations are interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately a total of 250 to 300 stations will be operated. A few of the more recently established stations have not yet begun to report radioactivity.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some continuous composite samples of 10 to 15 days are obtained.

Gross alpha and beta measurements are made on both suspended and dissolved solids in the raw surface water samples. The radioactivity levels of dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. It should be noted that with the cessation of weapons testing, beta activity in most raw waters is generally approaching a level attributable solely to natural beta activity. Natural beta activity can be two or three times the natural alpha activity based on the same nuclides being present. Some exceptions to this are seen, notably the data for the Columbia River and the Animas River. The results are reported in micromicrocuries per liter, and are shown for each station on a given river.

While beta determinations for the first two years of the Network operation have been done on each sample weekly, the alpha determinations are reported generally on a composite sample of more than one week. Beginning with samples taken in January 1960, beta determinations were performed on composite samples obtained by combining two weekly samples. The alpha data will be reported on three-month composite samples, with 1/3 of the stations being covered each month. All the data reported below represent the average of all information available for the month indicated.

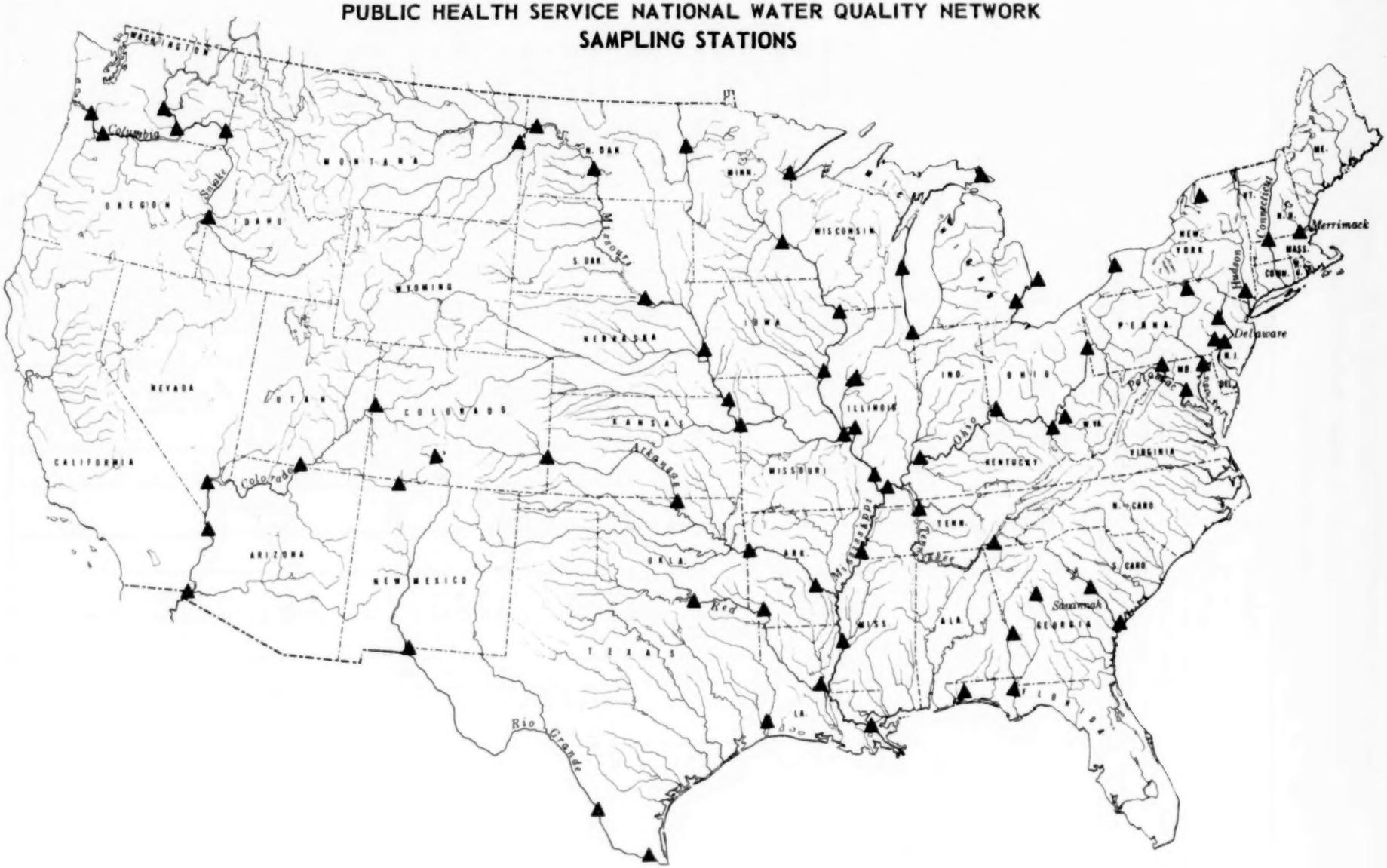
Strontium-90 data are reported as being the results of determinations on composite samples for a three-month period ending in the month shown.

Additional information and data may be obtained from the following sources:

1. "National Water Quality Network Annual Compilation of Data," PHS Publication. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.50.

2. "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, to Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 167-169.

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK
SAMPLING STATIONS



As of June 30, 1960

FIGURE 1

TABLE 1.--RADIOACTIVITY IN RAW SURFACE WATERS

Public Health Service National Water Quality Network

(Micromicrocuries per liter)

Station	Quarter ending 3/31/60	May, 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
ALSEA RIVER							
Alsea, Oreg.	0.1	0	0	0	-	-	-
ANIMAS RIVER							
Cedar Hill, N. Mex.	0.5	7	3	10	6	6	12
APALACHICOLA RIVER							
Chattahoochie, Fla.	-	0	0	0	0	0	0
ARKANSAS RIVER							
Coolidge, Kans.	1.2	4	0	4	8	29	37
Ponca City, Okla.	0.9	38	13	51	30	4	34
Fort Smith, Ark.	-	15	0	15	11	1	12
Pendleton Ferry, Ark.	0.8	55	5	60	14	2	16
CHATTAHOOCHIE RIVER							
Columbus, Ga.	0.5	0	<1	<1	0	0	0
COLORADO RIVER							
Loma, Colo.	0.1	5	35	40	3	5	8
Page, Ariz.	0.2	43	13	56	16	4	20
Hoover Dam, Ariz.-Nev.	0.7	0	14	14	0	8	8
Parker Dam, Ariz.-Calif.	0.3	0	0	0	<1	8	8
Yuma, Ariz.	0.3	0	5	5	<1	6	6
COLUMBIA RIVER							
Pasco, Wash.	0.6	40	282	322	0	0	0
Wenatchee, Wash.	0.4	-	-	-	-	-	-
Bonneville Dam, Ore.	0.3	29	105	134	0	0	0
Clatskanie, Oreg.	0.1	18	107	125	-	-	-
CONNECTICUT RIVER							
Northfield, Mass.	-	0	0	0	0	0	0
DELAWARE RIVER							
Martin's Creek, Pa.	0.6	0	0	0	0	0	0
Philadelphia, Pa.	0.9	0	<1	<1	0	0	0
GREAT LAKES							
Gary, Ind.	0.5	0	0	0	0	0	0
Duluth, Minn.	0.2	0	0	0	0	0	0
Detroit, Mich.	0.3	0	2	2	0	0	0
Buffalo, N. Y.	0.9	0	0	0	0	0	0
HUDSON RIVER							
Poughkeepsie, N. Y.	1.7	0	0	0	0	0	0

TABLE 1.--RADIOACTIVITY IN RAW SURFACE WATERS--Con.

Public Health Service National Water Quality Network

(Micromicrocuries per liter)

Station	Quarter ending 3/31/60	May, 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
ILLINOIS RIVER							
Peoria, Ill.	-	0	1	1	<1	2	2
KANAWHA RIVER							
Winfield Dam, W. Va.	0.2	0	0	0	0	0	0
MERRIMACK RIVER							
Lowell, Mass.	0.5	-	-	-	-	-	-
MISSISSIPPI RIVER							
Red Wing, Minn.	0.7	2	2	4	0	3	3
Dubuque, Iowa	1.4	0	0	0	-	-	-
Burlington, Iowa	1.0	0	42	42	0	0	0
East St. Louis, Ill.	0.5	1	1	2	1	3	4
Cape Girardeau, Mo.	0.4	14	12	26	-	-	-
West Memphis, Ark.	1.3	0	<1	<1	0	1	1
Delta, La.	1.0	8	2	10	3	0	3
New Orleans, La.	0.9	26	10	36	8	2	10
MISSOURI RIVER							
Williston, N. D.	-	0	4	4	0	3	3
Bismarck, N. D.	0.5	0	0	0	1	1	2
Yankton, S. D.	1.7	0	11	11	0	5	5
Omaha, Nebr.	0.4	14	9	23	7	5	12
St. Joseph, Mo.	0.9	32	10	42	8	5	13
Kansas City, Kans.	0.5	31	7	38	6	0	6
St. Louis, Mo.	0.9	40	24	64	16	5	21
OHIO RIVER							
East Liverpool, O.	0.5	0	7	7	0	0	0
Huntington, W. Va.	0.2	0	0	0	1	0	1
Cincinnati, O.	0.4	<1	<1	1	0	0	0
Evansville, Ind.	0.7	0	2	2	0	0	0
Cairo, Ill.	0.6	0	0	0	0	0	0
POTOMAC RIVER							
Williamsport, Md.	0.3	11	0	11	9	0	9
Great Falls, Md.	0.6	0	4	4	0	0	0
RED RIVER							
Denison, Tex.	1.4	0	2	2	1	0	1
Index, Ark.	0.7	3	0	3	8	0	8
Alexandria, La.	1.3	3	7	10	4	1	5
RIO GRANDE RIVER							
El Paso, Tex.	-	1	0	1	2	6	8
Laredo, Tex.	0.1	0	0	0	0	1	1
Brownsville, Tex.	0.6	-	-	-	-	-	-

TABLE 1.--RADIOACTIVITY IN RAW SURFACE WATERS--Con.

Public Health Service National Water Quality Network

(Micromicrocuries per liter)

Station	Quarter ending 3/31/60	May, 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
SABINE RIVER							
Ruliff, Tex.	-	0	4	4	0	0	0
ST. CLAIR RIVER							
Port Huron, Mich.	-	0	0	0	0	0	0
ST. LAWRENCE RIVER							
Massena, N. Y.	-	0	0	0	0	0	0
ST. MARY'S RIVER							
Sault Ste. Marie, Mich.	0.3	0	0	0	0	1	1
SCHUYLKILL RIVER							
Philadelphia, Pa.	0.5	0	0	0	0	0	0
SAVANNAH RIVER							
Port Wentworth, Ga.	0.2	<1	29	29	<1	0	<1
SNAKE RIVER							
Wawawai, Wash.	0.3	0	<1	<1	0	0	0
Weiser, Idaho	-	<1	4	5	0	3	3
SUSQUEHANNA RIVER							
Sayre, Pa.	-	0	0	0	0	0	0
Conowingo, Md.	-	2	4	6	<1	<1	<1
TENNESSEE RIVER							
Chattanooga, Tenn.	0.4	0	81	81	0	1	1
YELLOWSTONE RIVER							
Sidney, Mont.	1.2	0	2	2	1	3	4

MONITORING OF WATER SUPPLIES AROUND THE NEVADA TEST SITE

By contract with the Atomic Energy Commission the Public Health Service has conducted an off-site monitoring program around the Nevada Test Site since 1955. Included in the program have been measurements of radioactivity in water supplies. These data have been reported in the Atomic Energy Commission's 13th, 14th, 18th and 23rd Semiannual Reports to Congress and by the Public Health Service in the 1957 Congressional Hearings, "The Nature of Radioactive Fallout and Its Effects on Man."

Table 1 gives a brief description of each water sampling point. The map in Fig. 1 summarizes the data on gross beta radioactivity in water supplies for the two-month period, May-June 1960.

The lower limit of detectability with the equipment used is about 10^{-8} microcuries per milliliter (10 micromicrocuries per liter).

TABLE 1.—DESCRIPTION OF WATER SAMPLING POINTS

Nevada Test Site

Location	Source	Population served
Las Vegas	13 wells—650 to 1,250' depth plus Lake Mead supply.	40,000
Game Reserve	400' drilled well	20
Indian Springs	600' drilled well	Average 250
Pahrump	75' driven well	10-50
Ash Meadows	Spring 25' deep	8
Lathrop Wells	3 wells—600' deep	Average 15
Beatty	Spring	550
Lida Junction	125' drilled well	2-10
Goldfield	Spring	Average 200
Tonapah	2 drilled wells—60' depth	Average 1,500
Warm Springs	Multiple springs—no improvement	10
Diablo	Well	State Highway Station
Lincoln Mine	2 driven wells	3
Caliente	Springs	Average 10-12
Crystal Springs	Free flowing spring	0
Alamo	2 wells—50-67' deep	Average 175
Pahranagat Lake	Surface	Not used for domestic purposes
Butler Ranch	Flowing spring	1
Warm Spring Ranch	Flowing spring from earth fault	Public park with swimming pool
Logandale	Drilled well	300
Ballistic Range	Drilled well	10-15

GROSS BETA MEASUREMENTS IN WATER SUPPLIES IN OFF-SITE AREAS OF THE NEVADA TEST SITE FOR MAY-JUNE 1960

(μc/ml at count time)

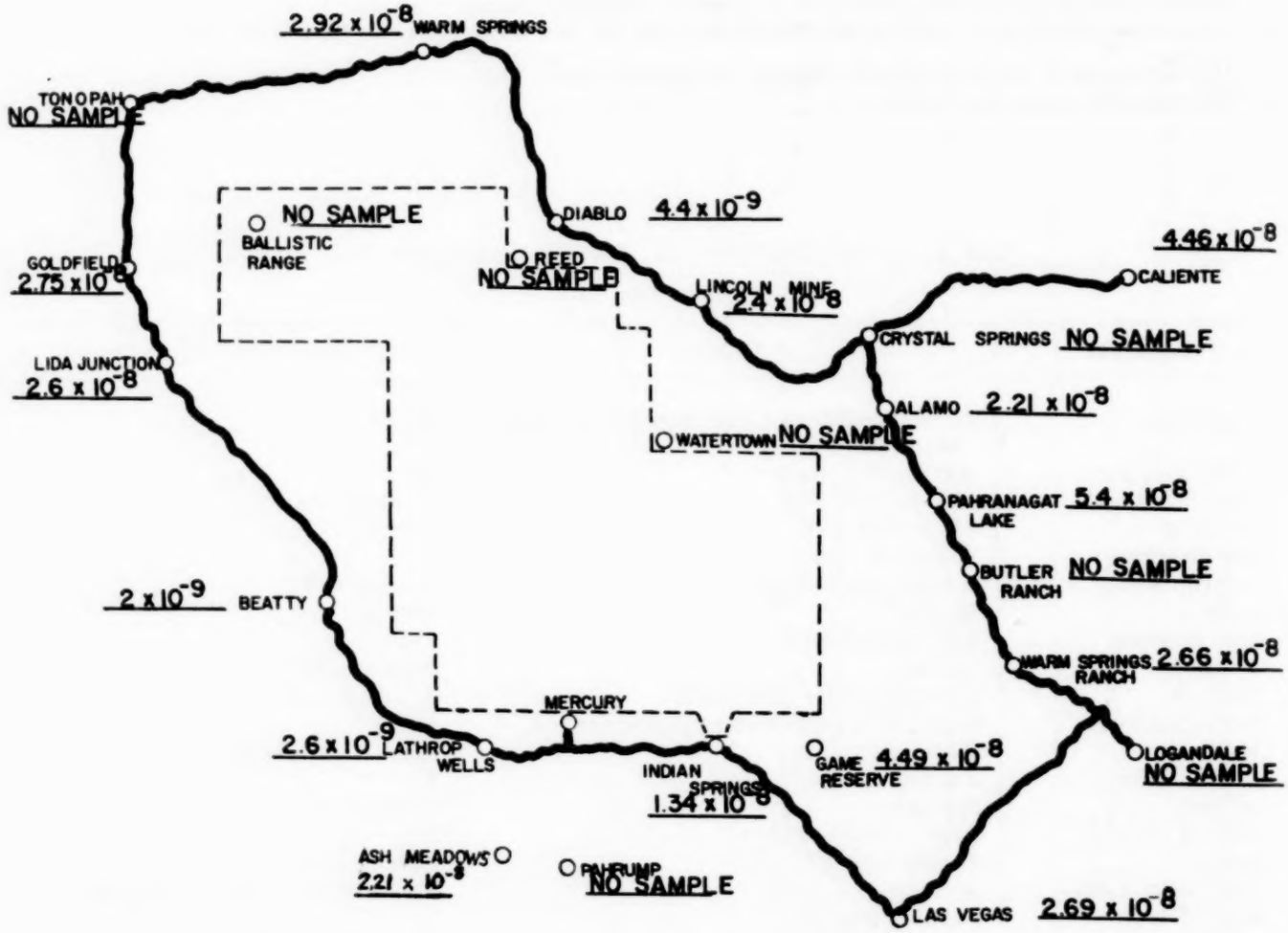


FIGURE 1

SECTION IV.—OTHER DATA

EXTERNAL GAMMA ACTIVITY

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Portable survey instruments are available at the stations of the Radiation Surveillance Network and one of their uses is to record external gamma radiation. These readings are not precise, especially for measurement of low levels but they can show the presence or absence of any significant increases above background. The differences among the values shown on the following table are, within the variance anticipated due to differences in normal background and in instrument response characteristics.

TABLE 1.--EXTERNAL GAMMA ACTIVITY
Public Health Service Radiation Surveillance Network
June 1960

Station Location	Average*	Station Location	Average*
	mr/hr		mr/hr
Alaska, Anchorage	0.01	Mississippi, Pascagoula	(**)
Alaska, Fairbanks	0.01	Missouri, Jefferson City	0.01
Alaska, Juneau	0.02	Montana, Helena	0.03
Arizona, Phoenix	0.01	New Jersey, Trenton	0.02
Arkansas, Little Rock	0.02	New Mexico, Santa Fe	0.04
California, Berkeley	0.01	New York, Albany	0.02
California, Los Angeles	0.01	North Carolina, Gastonia	0.02
Colorado, Denver	0.02	Ohio, Cincinnati	(**)
Connecticut, Hartford	0.01	Oklahoma, Oklahoma City	0.02
District of Columbia	0.02	Oklahoma, Ponca City	0.04
Florida, Jacksonville	0.01	Oregon, Portland	0.02
Georgia, Atlanta	0.02	Pennsylvania, Harrisburg	0.01
Hawaii, Honolulu	0.02	Rhode Island, Providence	0.02
Idaho, Boise	0.02	South Carolina, Columbia	0.02
Illinois, Springfield	0.01	South Dakota, Edgemont	(**)
Indiana, Indianapolis	0.01	South Dakota, Pierre	0.02
Iowa, Iowa City	0.02	Texas, Austin	0.01
Kansas, Topeka	0.02	Texas, El Paso	0.02
Louisiana, New Orleans	0.01	Utah, Salt Lake City	0.02
Maryland, Baltimore	0.02	Virginia, Richmond	0.01
Massachusetts, Lawrence	0.01	Washington, Seattle	0.02
Michigan, Lansing	0.02	Wyoming, Cheyenne	0.02
Minnesota, Minneapolis	0.01		

*Readings taken three feet above the ground.
**No data received.

SUMMARY OF RESEARCH RESULTS
RELATED TO ENVIRONMENTAL RADIOACTIVITY

U. S. Atomic Energy Commission

The results of research in the Atomic Energy Commission's fallout studies program at their various contract laboratories through mid-1960 are summarized below. Refer to the 1959 AEC "Annual Report to the Congress" for a more complete description of individual programs. This summary was prepared by the Division of Biology and Medicine, AEC.

University of California at Los Angeles

Studies of the uptake of cesium-137 and natural potassium by Ladino clover, made at the University of California at Los Angeles, have shown that the uptake of cesium-137 depends on soil type and that the uptake increases as the soil potassium is reduced by continued use of the soil for growing plants. Stable cesium even at toxic levels, added to the soils caused an increase in uptake of cesium-137 while addition of potassium caused a decrease in its uptake. Other studies involving the uptake of strontium-90 by different crop plants showed that uptake among the different types of plants varied by a factor as high as 10 on the same soil. For cereal crops, the grain showed concentrations of strontium-90 only about one-fifth of that in the foliar portion of the plants. The tops of potatoes contained about 50 times that of the tubers. Temperature and light intensity were also shown to affect strontium-90 uptake from soils in barley and beans. Studies of the uptake of stable and radioactive isotopes of cesium, potassium, strontium and calcium have shown that the addition of the stable isotope of each caused an increase in the uptake of the respective radioactive isotope. The stable isotopes appear to increase the water soluble fraction of the radioactive isotope in soils and clay minerals.

Hanford Laboratories

Studies at the Hanford Laboratories have shown that with as much as one ton of phosphorus per acre no reduction of strontium-90 uptake was noted on plants grown on acidic Cinebar soil, but uptake was depressed two to four-fold in calcareous soils. Although this provides a method of reducing uptake of strontium-90 from calcareous soils the amount of phosphorus required is so great that the meager benefit brought about would not warrant its general use. The effect of phosphorus on calcium uptake appeared to be comparable to that on strontium-90 uptake. Studies of strontium-90 in plants grown on different soils suggest that strontium-90 movement is impaired when plants are grown in alkaline soils. After irrigation, marked increases in Zn^{65} uptake from water containing this nuclide are observed only for grass grown where sod is established. Presumably such a sod acts as an excellent absorbing mechanism for taking the Zn^{65} up into the plant material.

In other studies concerned with the accumulation of cesium-137 by plants grown on nutrient solution, it was observed that the accumulation of Cs^{137} was halved when the potassium in solutions was increased 100-fold, but was enhanced by the addition of non-radioactive cesium. Such increases from soil have usually been ascribed to changes in availability whereas this would not appear to be the case with nutrient solution. The fact that it took a 100-fold increase in potassium to cut the uptake of cesium-137 to one-half of its former value indicates that the plants change the degree with which they discriminate between cesium and potassium, and consequently, that the cesium-137/potassium ratio is of little value in predicting future contamination levels in plants from known levels in soils.

Visible toxic symptoms are produced where ratios of non-radioactive cesium to potassium in the root substrate are one or greater. These symptoms are typical of potassium deficiency, but analysis of plant tissues failed to show any decrease in potassium concentration within the plants. The results suggest a competitive mechanism in the metabolism of these two ions. Such competition does not appear to exist for the absorption and translocation processes since potassium and cesium seem to behave independently. In similar studies an increase of two to three-fold in potassium uptake in plant tissue depresses rubidium-86 concentration by five to ten-fold. Thus cesium and potassium appear to be independently accumulated, whereas a partial interaction of potassium on rubidium uptake occurs. The variability of the observed ratios for rubidium/potassium and cesium/potassium demonstrates that neither rubidium nor cesium are ideal tracers for potassium in plant uptake studies.

There was evidence that the roots and stems, in that order, exhibit a preference for strontium, and there is a preferential translocation of calcium from these tissues. This selective retention of strontium occurred only at low strontium/calcium substrate ratios.

Uptake of cesium-137 into bean plants was greater when soil moisture was limited than when soil moisture was ample. Variations in available soil moisture did not influence uptake of calcium-45 or strontium-90.

It appears from studies at Hanford that the mature rat's fecal excretion of intraperitoneally administered radioisotope is essentially the same for strontium and calcium, whereas urinary excretion of either element is influenced by the calcium level in the diet. The retention of both strontium-90 and calcium-45 were dependent on the dietary calcium—calcium-45 to a much greater extent than strontium-90. Discrimination between strontium and calcium is effected primarily in the process of absorption from the gastrointestinal tract. These results combine to give a picture of strontium metabolism which differs in significant details from the behavior of calcium.

Studies using a perfusion technique showed that although there is a measurable influx of strontium through the gills of fish, the outflux rate is approximately 100 times greater. Other tests comfirm that ionic strontium can be pumped out of the gills against a concentration gradient. This suggests the gills are a primary organ of strontium regulation in fish.

An ion exchange separation procedure was developed at the Hanford Laboratories for removing metabolized strontium-90 from sheep milk. The radiochemical yield is greater than 82 percent even in the presence of 100 times as much calcium as strontium. This study showed that metabolized strontium-90 can be removed from milk by ion exchange techniques without the necessity of special pre-treatment due to some possible compound formation with the other components of the milk.

Los Alamos Scientific Laboratory

A study of changes in the availability of strontium-90 to plants as a function of the environment in which various nuclear tests have occurred was completed in recent months by the Los Alamos Scientific Laboratory. Nuclear debris was examined in which the principal component was, variously, sodium chloride from explosions, ferric oxide from iron tower explosions and air bursts aluminum oxide from aluminum tower explosions. and siliceous material from tests conducted in the presence of large amounts of silica. It was desired to ascertain whether any of these materials lowered the availability of their contained fission products to living plants. The largest effect observed was a decrease of approximately a factor of two in strontium-90 availability from nuclear devices exploded on iron towers or exploded in air at altitudes high enough to avoid inclusion of ground debris. Of the material examined, those from which strontium is least available are iron oxide and aluminum oxide. A nuclear explosion conducted in such a way as to maximize the incorporation of strontium-90 into one or another of these materials might be expected to decrease the availability of this nuclide by some unpredictable factor over what has been observed in any of the debris studies to date

University of Tennessee

Studies in the removal of radioactivity from certain foods have continued at the University of Tennessee Agricultural Research Laboratory. It has been found that cooking beef loin roasts with bones causes movement of strontium from the bone into the meat and drippings. Cesium-134, used as an artificial contaminant, has been removed from milk by an ion exchange resin. Using a batch technique 75 percent of the cesium-134 was removed. Using a column of resin about 99 percent was removed from the first 150 milliliters of milk passed through the column and 95 percent was removed from the twentieth 10 milliliter portion. About 90 percent of iodine-131 has been removed from milk by batch technique with a resin.

To study the effect on nutritive value of ion exchange-treated milk homogenized, vitamin D fortified milk was treated with Dowex 50-W in the calcium form by the batch technique using a milk resin ratio of 20 to 1. Both the treated milk and the control were fortified with copper and iron and fed to weanling rats as the sole source of nutrients. Failure to achieve normal weight gain was noted for the males but not for the females. No impairment of male or female fertility was noted at the end of eight weeks.

ENVIRONMENTAL LEVELS OF RADIOACTIVITY AT ATOMIC ENERGY COMMISSION INSTALLATIONS

The United States Atomic Energy Commission has recently initiated the reporting of radioactivity data collected in the vicinity of major Commission installations. The data are from routine monitoring programs around Commission plants and laboratories where operations are of such a nature that plant perimeter surveys are required.

The yearly summaries of data for the year 1959 and the initial quarterly reports for the first three months of 1960 have been provided the Public Health Service. Summarized below are the yearly and first quarterly reports for seven of the installations. The reports for the remaining installations will be included in the December 1960 issue.

AIRCRAFT NUCLEAR PROPULSION DEPARTMENT

General Electric Company
Cincinnati, Ohio

June 27, 1960

The information presented in this report relates to the various programs conducted by the General Electric Company's Aircraft Nuclear Propulsion (ANP) Department, Cincinnati, Ohio, in the monitoring of the levels of radioactivity in the air and water in and around the area occupied by the ANP Department's plant. The prime purpose of these intensive monitoring programs is to assure the highest standards of health protection for employees and the general population of the surrounding areas.

Airborne Activity

The off-site or community monitoring program for alpha and beta-gamma airborne activity is accomplished by the use of a mobile sampling unit consisting of a 1 1/2 ton panel truck in which are installed a power generator, sampling equipment and meteorological instrumentation. Sampling is generally confined to the communities and General Electric sites within a one mile radius of the ANP Department.

The monitoring interval is one hour at each location with approximately three sets of downwind samples taken per day. Also on each sampling day a set of upwind background measurements are completed for comparison purposes. During the sampling period, M.S.A. electrostatic precipitators are used for the collection of alpha activity from air samples, while beta-gamma activity is collected by filtering the air through Whatman No. 41 filter paper. Proportional counters are used for analyzing the collected air samples. The beta-gamma samples are held for five days before being counted. The average concentrations of long-lived alpha and beta-gamma activity in air are summarized in Table 1.

TABLE 1.--AIRBORNE ACTIVITY

	1959		First quarter 1960	
	No. samples	Average concentration $\mu\mu c/m^3$	No. samples	Average concentration $\mu\mu c/m^3$
Long Lived Alpha				
Upwind	479	0.042	86	0.034
Downwind	734	0.041	153	0.038
Beta-Gamma Activity				
Upwind	325	5.9	67	0.37
Downwind	515	5.4	109	0.37

Liquid Waste Activity

The ANP Department is equipped with a special drain system and retention tanks whereby liquid wastes from the laboratory areas are collected, held and monitored before their disposal to the Cincinnati Metropolitan Sewerage System. The purpose of this liquid effluent system is to provide a positive method for assuring that the liquid waste effluent from the ANP Department is well within the limits for safe disposal as specified by the City of Cincinnati and the National Committee on Radiation Protection. Table 2 summarizes the results of the samples collected from the liquid effluent holding tanks.

TABLE 2.--LIQUID WASTE FROM DRAIN SYSTEM

	1959	First quarter 1960
Total Volume	4,005,000 gallons	979,000 gallons
Monthly Average Volume	333,750 gallons	326,333 gallons
Average Concentration	4,100 μc U/liter	3,100 μc U/liter
Control Limit *	72,700 μc U/ liter	153,200 μc U/liter

*Control limit in use at these particular times. Limit applied in 1960 was raised due to increase in volumes of dilution water in 1959.

General Conclusions

The data obtained in the environmental airborne and liquid effluent radioactivity monitoring programs during 1959 and the first quarter of 1960 indicate that the operations at ANP Department contributed an insignificant amount of radioactivity to the air and liquid wastes discharged to the City of Cincinnati Sewerage System.

BETTIS ATOMIC POWER LABORATORY

Westinghouse Electric Corporation
Pittsburgh, Pennsylvania

June 1, 1960

The Bettis Atomic Power Laboratory (BAPL) at Pittsburgh, Pennsylvania, operated for the United States Atomic Energy Commission (AEC) by the Westinghouse Electric Corporation, was established in 1949 and since that time has been engaged in research and development work related to naval atomic propulsion systems and the central station atomic power reactor at Shippingport.

Liquid Waste Activity

The liquid effluent discharged from the Laboratory is sampled continuously and a composite sample is collected and analyzed weekly. This measured concentration may include fallout from rainfall and runoff that has entered the effluent line through the Laboratory storm drainage system. The measured concentrations of total radioactivity and strontium-90 in the liquid effluent discharged during 1959 and first quarter of 1960 are summarized in Table 1.

TABLE 1.--RADIOACTIVITY IN LIQUID EFFLUENT

Periods	Gross radioactivity μμc/liter	Strontium-90 μμc/liter
First Quarter 1959	270	4.5
Second Quarter 1959	140	2.4
Third Quarter 1959	120	(*)
Fourth Quarter 1959	190	(*)
First Quarter 1960	230	(*)
January 1960	330	(*)
February 1960	150	(*)
March 1960	130	(*)

*Results will be reported in BAPL's second quarter report, to be published in a subsequent issue.

External Beta-Gamma Activity

External beta-gamma radiation levels are continuously monitored and recorded at a monitoring station located on the western boundary of the Laboratory property. The results of the data taken during 1959 and the First quarter of 1960 are listed in the following table.

TABLE 2.–EXTERNAL BETA-GAMMA ACTIVITY

Periods	Average beta-gamma radiation levels (millirads/hr)
First Quarter 1959	0.013
Second Quarter 1959	.014
Third Quarter 1959	.015
Fourth Quarter 1959	.015
First Quarter 1960	.016

The values are within the 0.008 to 0.038 mr/hr range of background gamma radiation levels measured in 1957 by the Atomic Energy Commission throughout the United States.

Fallout Activity

Fallout samples are collected at six stations near the boundary of the Laboratory property. Samples are collected in open trays that are lined with a special gummed paper. These stations measure not only day-to-day fallout from the atmosphere, but also can pick up fallout that may be present in dust created by the movement of vehicles and construction work in the immediate vicinity. The average concentrations of radioactivity in the fallout samples collected weekly during 1959 and the first quarter of 1960 are presented in the following table.

TABLE 3.--BETA RADIOACTIVITY IN FALLOUT

(mc/mi^2/month)

Periods	Average beta radioactivity	
	Upwind	Downwind
First Quarter 1959	155	162
Second Quarter 1959	136	136
Third Quarter 1959	9	10
Fourth Quarter 1959	5	8
First Quarter 1960	5	5
January 1960	4	4
February 1960	7	8
March 1960	4	4

Soil Activity

Soil samples from the perimeter of the Laboratory have been collected periodically since 1949. The following table compares concentrations of radioactivity contained in soil samples collected in 1949 and 1959.

TABLE 4.--ALPHA AND BETA RADIOACTIVITY IN SOIL

(Average concentrations)

Year samples collected	Alpha, $\mu\mu$c/gram	Beta, $\mu\mu$c/gram
1949	18	16
1959	18	27

These data indicate some general increase in concentrations of beta radioactivity in the soil from 1949 to 1959. This increase is believed to be due to fallout from past weapons testing. Similar increases have been observed in soil samples collected in other parts of the country.

Conclusions

The measurements of radioactivity in the fallout and the soil, as well as measurements of background radiation intensities at the boundaries of the Bettis Atomic Power Laboratory throughout 1959 and the first quarter of 1960, show no significant effects on the environmental radioactivity levels caused by Laboratory operations.

CONNECTICUT AIRCRAFT NUCLEAR ENGINE LABORATORY

Pratt & Whitney Aircraft
Division of United Aircraft Corporation
Middletown, Connecticut

April-May 1960

The environment on and around the Connecticut Aircraft Nuclear Engine Laboratory (CANEL) site has been sampled throughout 1959 and the first quarter of 1960. The environmental monitoring program consisted of collection and analysis of water, soil, silt, drinking water, Connecticut River water and silt, process water, domestic sewer water, precipitation, fallout, and air samples. Vegetation samples were collected but have not been analyzed.

The CANEL facility has two retention tank vaults which are designed to collect laboratory liquid wastes which have the potential of being radioactive. These tanks are sampled and analyzed before they are permitted to be released to the Connecticut River. All samples are analyzed for gross alpha and gross beta activity.

The data from these samples (air, water, soil, silt, precipitation, and fallout) have been analyzed and compared with similar data taken in 1958. There have been no cases of statistically significant increases in activity.

The data from the environmental water, soil and silt samples were statistically analyzed by using three variables of classification; i.e., date, distance and direction from the center of the CANEL site. Statistically significant effects appeared for these variables and/or their combinations which initiated a review of the operations and the meteorological conditions. No unusual incidents occurred at CANEL which could reasonably be expected to have caused these variations. Selected stacks, which have the highest probability of emitting radioactive materials, were continuously monitored. There is no evidence to justify concern about the amount of material which may have been released from these stacks. Therefore, it has been concluded that these statistically significant effects have been caused by natural variations and are not due to CANEL operations.

The following tables summarize the data from the environmental monitoring program.

TABLE 1.--ENVIRONMENTAL WATER

Activity	1959		First quarter 1960	
	No. samples	Average μμc/liter	No. samples	Average μμc/liter
Soluble Alpha	320	0.20	60	0.16
Soluble Beta	320	11.7	60	4.0
Insoluble Alpha	320	0.24	60	0.01
Insoluble Beta	320	12.3	60	2.8

TABLE 2.--SOIL

Activity	1959		First quarter 1960	
	No. samples	Average μμc/gram	No. samples	Average μμc/gram
Alpha	448	2.11	84	2.63
Beta	448	37.8	84	23.8

TABLE 3.--DRINKING WATER

Two Wells

Activity	1959		First quarter 1960	
	No. samples	Average μμc/liter	No. samples	Average μμc/liter
Soluble Alpha	18	0.21	5	0.72
Soluble Beta	18	7.0	5	4.13
Insoluble Alpha	18	0.15	5	0.07
Insoluble Beta	18	3.27	5	5.47

TABLE 4.--CONNECTICUT RIVER WATER

Location	Activity	1959		First quarter 1960	
		No. samples	Average μμc/liter	No. samples	Average μμc/liter
North Boundary of Site	Sol. α	15	0.25	3	0.14
	Sol. β	15	11.4	3	1.8
	Insol. α	15	0.21	3	0.21
	Insol. β	15	5.9	3	3.0
South Boundary of Site	Sol. α	15	0.23	3	0.08
	Sol. β	15	10.4	3	3.47
	Insol. α	14	0.24	3	0.08
	Insol. β	14	9.5	3	6.36

TABLE 5.--PRECIPITATION

Activity	1959		First quarter 1960	
	No. samples	Average μμc/liter	No. samples	Average μμc/liter
Soluble Alpha	61	0.22	18	0.62
Soluble Beta	61	144	18	28.3
Insoluble Alpha	61	0.18	18	0.10
Insoluble Beta	61	39.9	18	5.64

TABLE 6.--FALLOUT

Activity	1959		First quarter 1960	
	No. samples	Average $d/m/ft^2$	No. samples	Average $d/m/ft^2$
Alpha	247	2.94	50	2.76
Beta	247	377	50	258

TABLE 7.--AIR SAMPLES

Location	Activity	1959		First quarter 1960	
		No. samples	Average $\mu\mu c/m^3$	No. samples	Average $\mu\mu c/m^3$
Weather station	Alpha	181	0.002	41	0.00265
	Beta	180	1.79	41	.16
On and Around Site	Alpha	24	.006	-	-
	Beta	24	1.58	-	-

TABLE 8.--SUMMARY

	1959		First quarter 1960	
	Average total gross activity $\mu\mu c$/liter	Percent MPC*	Average total gross activity $\mu\mu c$/liter	Percent MPC*
Environmental water	24.4	24.4	7.0	7.0
Drinking water	10.6	10.6	10.4	10.4
Connecticut River water	19.1	19.1	7.6	7.6
Precipitation	184.4	184.4	34.7	34.7

*MPC is 100 $\mu\mu c$/liter for 168-hour per week exposure for isotopes other than Ra^{226} and Ra^{228}, as stated in National Bureau of Standards Handbook 69, Table No. 3, issued June 5, 1959.

MOUND LABORATORY

Monsanto Chemical Company
Miamisburg, Ohio

July 5, 1960

The Mound Laboratory is operated by the Monsanto Chemical Company under contract to the Atomic Energy Commission.

Monsanto Chemical Company has conducted a routine environmental air monitoring program in the Southeastern section of Ohio since operations began at Mound Laboratory in 1949. Sixty-seven locations are routinely monitored in all directions from the Laboratory out to a distance of approximately 40 miles.

The radioactive nuclides presently in use at the Laboratory are polonium-210 and plutonium-239 which are alpha emitters. During the periods covered by the following air monitoring results, no radioactive materials have been used which could have contributed any measurable gamma or beta radiation to the environment. Therefore, measurements have naturally been confined to alpha.

Tables 1 to 3 show gross alpha in air and water for the area around Miamisburg, Ohio for 1959 and the first quarter of 1960. Readings for 1959 contain polonium-210 plus natural background, while the first quarter of 1960 includes the possibility of plutonium-239.

TABLE 1.--GROSS ALPHA IN AIR DURING 1959

(Polonium plus natural background)

Distance from Mound Laboratory	Number of sampling locations	Average concentration $\mu\mu c/m^3$
0-5 miles	12	0.123
5-15 miles	15	.118
15-30 miles	26	.094
30-40 miles	14	.116

TABLE 2.--GROSS ALPHA ACTIVITY IN AIR FROM POLONIUM AND PLUTONIUM

First quarter 1960

(Not including natural background)

Distance from Mound Laboratory	Number samples	Number of sampling locations	Average concentration $\mu\mu c/m^3$
0-5 miles	70	12	0.036
5-15 miles	13	15	.027
15-30 miles	23	26	0
30-40 miles	13	14	.027

TABLE 3.--GROSS POLONIUM RADIOACTIVITY IN THE GREAT MIAMI RIVER

Sample location	Average concentration in $\mu\mu c$/liter	
	Calendar year 1959	First quarter 1960
Mound lab. effluent	136	326
200 yards downstream	8.8	0.7
250 " "	4.9	0.9
300 " "	4.1	4.5
1 mile "	2.0	0.2
2 miles "	4.4	.9
5 miles "	1.4	1.6
over 5 miles "	0.0	0.0

PORTSMOUTH GASEOUS DIFFUSION PLANT

Goodyear Atomic Corporation
Portsmouth, Ohio

Issued July 1960

The U. S. Atomic Energy Commission facility in Pike County, Ohio, operated by the Goodyear Atomic Corporation, is a gaseous diffusion plant. Gaseous diffusion is the process by which isotopes of uranium are separated for useful purposes. Uranium as found in nature consists of three isotopes, uranium-238, uranium-235, and uranium-234. It is a naturally occurring slightly radioactive element.

The chemical processing of gaseous uranium presents the ordinary problems of the chemical industry which use toxic solvents and extracting solutions. Fumes and mists must be controlled and contaminants removed by filtering, scrubbing, or other practical means to prevent atmospheric contamination.

An extensive environmental survey is conducted on a monthly basis for radioactive materials that may be released from the plant to check the effectiveness of controls which are used. The program is also designed to determine the effect, if any, on the surrounding environment. The routine program consists of sampling water, mud, air, and the general radiation background levels. The samples are collected up to five miles from the plant at various distances and directions with the majority being in the prevailing wind direction. The following tables report the concentrations of alpha and beta-gamma activity in air and stream water for 1959 and the first quarter of 1960.

TABLE 1.--GROSS STREAM WATER ACTIVITY

(Average concentrations in μμc/liter)

Stream & location from plant	Calendar year 1959					First quarter 1960				
	No. samples	Alpha	Percent MPC*	Beta & Gamma	Percent MPC*	No. samples	Alpha	Percent MPC*	Beta & Gamma	Percent MPC*
Scioto River 4-5 mi SSW	11	4.9	0.025	18.9	0.095	3	2.7	0.014	18	0.090
Salt Creek 2-3 mi SSW	11	4.1	.021	18.4	.092	3	4	.020	18	.090
Salt Creek 1 mi S	11	14.4	.072	31.5	.158	3	5.8	.029	18	.090
Big Beaver 3-4 mi ENE	11	5.8	.029	14.8	.074	3	2.3	.012	18	.090
Big Beaver 2-3 mi NNW	11	8.1	.041	16.6	.083	3	4	.020	13.5	.068
Scioto River 4-5 mi N	11	4.9	.025	31.9	.160	3	3	.015	13.5	.068
Little Beaver 2 mi NW	11	69.3	.347	134.7	.674	3	32.4	.162	72	.360
Little Beaver 1-2 mi NNW	11	109.0	.595	354.0	1.770	3	16	.080	40.5	.203
Plant drainage 0 mi SW	10	4.9	.025	36.4	.182	3	3.6	.018	18	.090
Plant drainage 0 mi W	11	7.6	.038	33.3	.167	3	6	.030	22.5	.113
Plant drainage 0 mi NE	11	423.4	2.117	854.4	4.297	3	126	.630	85.6	.428
Little Beaver 1 mi E	11	35.6	.178	22.5	.113	3	1.4	.007	18	.090
Big Beaver 2 mi NW	11	31.5	.158	54.5	.273	3	1.4	.007	13.5	.068
Scioto River 1-2 mi W	11	9.0	.045	24.3	.122	3	2.7	.014	13.5	.068

*The values for the maximum permissible concentrations (MPC) for air and water are one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U. S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

TABLE 2.--GROSS AIR ACTIVITY

(Average concentrations in $\mu\mu c/m^3$)

Location from plant	Calendar year 1959					First quarter 1960				
	No. samples	Alpha	Percent MPC*	Beta & Gamma	Percent MPC*	No. samples	Alpha	Percent MPC*	Beta & Gamma	Percent MPC*
5-6 mi W	12	0.08	4.0	5.0	0.5	3	0.008	0.4	0.4	0.04
2-3 mi W	12	.08	4.0	3.3	.33	3	0	0	.009	.01
4 mi NW	12	.08	4.0	4.6	.46	3	.008	0.4	.08	.01
3-4 mi SW	12	.1	5.0	2.7	.27	3	.01	0.5	.13	.01
4-5 mi N	12	.05	2.5	3.1	.31	3	.02	1.0	.02	0
2-3 mi NNW	12	.08	4.0	3.8	.38	3	.02	1.0	.008	0
2-3 mi N	12	.03	1.5	5.2	.52	3	0	0	.09	.01
1-2 mi S	12	.08	4.0	3.3	.33	3	.02	1.0	.27	.03
3-4 mi SSE	12	.09	4.5	2.6	.26	3	.02	1.0	.08	.01
1 mi E	12	.5	25.0	2.9	.29	3	.02	1.0	.21	.02
5 mi E	12	.05	2.5	3.5	.35	3	.008	.4	.1	.01
5-6 mi NE	12	.1	5.0	2.3	.23	3	.04	2.0	.4	.04
5-6 mi NE	12	.1	5.0	2.5	.25	3	.09	4.5	.4	.04
4 mi NE	12	.08	4.0	2.3	.23	3	.08	4.0	.27	.03
2-3 mi SSW	12	.05	2.5	2.4	.24	3	.05	2.5	.4	.04

*The values for the maximum permissible concentrations (MPC) for air and water are one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U. S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

TABLE 3.--GROSS BETA-GAMMA BACKGROUND RADIATION LEVELS

(Millirads/hour)

Location from plant	Calendar year 1959		First quarter 1960	
	No. samples	Average rate	No. samples	Average rate
5-6 mi W	12	0.031	3	0.022
2-3 mi W	12	0.024	3	0.016
4 mi NW	12	0.021	3	0.011
3-4 mi SW	12	0.025	3	0.019
4-5 mi N	12	0.033	3	0.013
2-3 mi NNW	12	0.019	3	0.010
2-3 mi N	12	0.034	3	0.013
1-2 mi S	12	0.030	3	0.015
3-4 mi SSE	12	0.021	3	0.017
1 mi E	12	0.029	3	0.018
5 mi E	12	0.044	3	0.022
5-6 mi NE	12	0.029	3	0.016
5-6 mi NE	12	0.028	3	0.015
4 mi NE	12	0.024	3	0.014
2-3 mi SSW	12	0.032	3	0.016

SIC PROTOTYPE REACTOR FACILITY

Combustion Engineering, Inc.
Windsor, Connecticut

July 1960

The SIC Prototype is a land-based nuclear submarine power plant facility. This facility is operated for the United States Atomic Energy Commission by the Naval Reactors Division of Combustion Engineering, Inc., at Windsor, Connecticut. The SIC Prototype contains a pressurized water reactor. It is used to conduct research and development work as well as to train personnel in operation of naval reactor power plants. Power reactor operations at the Windsor facility were initiated in December of 1959.

Essentially all of the radioactive wastes originate from the activation of minute amounts of impurities and corrosion products in the circulating water used as the reactor coolant. Small quantities of gaseous waste result from the activation of minute amounts of air dissolved in the coolant water.

The disposal methods and limits in use at the Prototype were reviewed by the Connecticut State Department of Health and their approval was obtained before operations began. Complete waste disposal records are maintained at this facility and these records are examined every four months by representatives from the State Department of Health.

Liquid Wastes

Liquid wastes are collected in 5000 gallon retention tanks. When a tank is full it is sampled and analyzed for radioactivity content. If the activity is below allowable discharge limits, the tank is released into the industrial waste system. If the activity is above the allowable discharge limit it is diluted to below acceptable limits and then released. Table 1 is a summary of gross radioactivity released to the Farmington River.

TABLE 1.--SUMMARY OF GROSS RADIOACTIVITY RELEASED TO THE FARMINGTON RIVER

Month	Total for month microcuries	Average per day microcuries	Averaged concentration released ($\mu\mu$c/liter)
January	24.5	0.79	59
February	15.3	0.53	57
March	19.2	0.62	77
	59.0		

The Farmington River is sampled monthly at various locations for determination of alpha and beta-gamma activity in river water and mud. The results of this sampling are presented in Table 2.

TABLE 2.--SUMMARY OF FARMINGTON RIVER MONITORING PROGRAM

First quarter 1960

Location	Water samples				Mud samples			
	No. samples	Alpha μμc/l	Beta-Gamma μμc/l	ppm uranium	No. samples	Alpha μμc/l	Beta-Gamma μμc/l	ppm uranium
UPSTREAM								
Spoonville Bridge	2	47	< 4.5	0.002	2	2.18	1.62	0.62
Above Brook	1	23	23	ND*	1	4.46	5.28	1.33
OUTLET								
Mouth of Brook	1	50	4.5	ND*	1	3.87	3.32	0.48
DOWNSTREAM								
Below Brook	1	36	< 4.5	0.001	-	-	-	-
Rainbow Dam	2	34	< 4.5	0.003	1	1.23	5.56	0.76
Windsor Bridge	2	< 23	4.5	ND*	1	2.55	< 1.6	1.3

*ND--non-detectable.

Table 3 presents a comparison of operational and pre-operational radioactivity levels of water samples from the Farmington River.

TABLE 3.--COMPARISON OF RESULTS OF FARMINGTON RIVER MONITORING PROGRAM

(μμc/liter)

Location	Pre-operational averages		First quarter averages	
	Alpha	Beta-gamma	Alpha	Beta-gamma
Upstream	35	17	55	5.2
Outlet	50	4.5	54	4.5
Downstream	23	< 4.5	30	5.6

Fallout

Radioactive fallout is collected on a weekly basis at six locations around the site and analyzed for gross radioactivity. Off-site fallout collections in neighboring towns are also made and analyzed for gross radioactivity. Table 4 presents this data.

TABLE 4.--SUMMARY OF BETA RADIOACTIVITY IN FALLOUT

First Quarter 1960

(mc/mi^2/month)

		Prototype site					Off-site in neighboring towns						
Station	1	2	3	4	5	6	22	23	24	26	28	29	30
No. of samples	12	11	11	2	12	11	10	9	8	9	11	11	5
Monthly average	3.87	3.05	2.12	1.00	2.47	3.43	2.75	1.76	1.90	1.83	2.82	2.09	2.45

Monthly average of all Prototype site sampling stations--2.66 mc/mi^2/month

Monthly average of all off-site sampling stations--2.23 mc/mi^2/month

Airborne Waste Effluent

Ventilation air from the submarine hull is continuously monitored at the exhaust stack. Airborne waste effluent radioactivity is summarized in Table 5.

TABLE 5.–SUMMARY OF AIRBORNE WASTE EFFLUENT BETA RADIOACTIVITY

(Taken at point of release)

Month	Average value $\mu\mu c/m^3$
January	55
February	40
March	75

Conclusion

Measurements of the radioactivity in the Farmington River, the industrial waste effluent from the plant, air and fallout in the vicinity of the SIC Prototype during the first quarter of 1960 showed no significant contribution of radioactivity from the Prototype to the environment.

WELDON SPRING PLANT

Mallinckrodt Chemical Works Uranium Division
Weldon Spring, Missouri

Issued July 1960

Off-site environmental monitoring programs are conducted at the Weldon Spring Plant of the Mallinckrodt Chemical Works (MCW) Uranium Division to provide a check on those programs established to minimize the release of uranium-bearing materials. This report presents the data obtained during 1959 and the first quarter of 1960.

Since the primary feed material for the MCW Uranium Division operations is natural uranium ore concentrates, off-site environmental releases from the operations are measured in the terms of uranium content, and expressed as special uranium microcuries in accordance with the National Bureau of Standards Handbook No. 69, page 14, Section 3.2, which defines a curie of recently extracted uranium as the sum of 3.7×10^{10} d/s from U^{238}, 3.7×10^{10} d/s from U^{234} and 9×10^{8} d/s from U^{235}. Hence at MCW, the special uranium curie value of an uranium-bearing sample found to contain an alpha activity of 3.7×10^{10} d/s is 0.5 curies.

An evaluation of the collected off-site environmental sampling program data indicates that the uranium concentration found in the Missouri River, off-site air, and adjacent lakes, streams, etc. did not differ significantly from the uranium concentration levels measured prior to the start-up of operations at the MCW Uranium facilities.

The following tables summarize the data from the off-site monitoring program.

TABLE 1.--URANIUM CONCENTRATIONS IN ENVIRONMENTAL WATER

(Average concentrations in $\mu\mu$c/liter)

Location	Calendar year 1959			First quarter 1960		
	No. samples	Concentration	Percent MPC *	No. samples	Concentration	Percent MPC *
Process sewer	261	300	1.5	45	970	4.8
Missouri River						
St. Louis Water Plant Intake	12	70	0.35	3	34	.17
St. Louis County Water Plant Intake	12	40	.20	3	33	.16
Nearby Lakes	36	20	.10	9	41	.20
Run-off Drainage Canals and Creeks	96	50	.25	24	71	.36

* The value for the maximum permissible concentration (MPC) for water is one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U. S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

TABLE 2.--URANIUM CONCENTRATIONS IN ENVIRONMENTAL AIR

(Average concentrations in $\mu\mu c/m^3$)

Location	Calendar year 1959			First quarter 1960		
	No. samples	Concentration	Percent MPC *	No. samples	Concentration	Percent MPC *
N of plant	14	0.23	12	3	0.33	16
NE of plant	13	.20	10	3	.24	12
E of plant	14	.17	8	3	.42	21
SE of plant	13	.20	10	-	-	-
S of plant	14	.04	2	3	1.04	52
SW of plant	13	.07	3	2	.41	20
W of plant	14	.04	2	-	-	-
NW of plant	13	.05	2	2	.24	12

* The value for the maximum permissible concentration (MPC) for air is one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U. S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

STRONTIUM-90 IN WHEAT AND WHEAT PRODUCTS

Health and Safety Laboratory
United States Atomic Energy Commission

The first non-milk analyses related to diet carried out by the Atomic Energy Commission Health and Safety Laboratory were a series of wheat samples from Minnesota. This sampling was then extended to cover the major wheat producing areas in the United States. The first sampling was of the 1958 crop and additional samplings have been made for 1959 and will be made for 1960.

There has been some question as to whether the Sr^{90} in wheat was incorporated into the grain or whether it was merely present as a surface contaminant. A number of the samples collected for 1958 were taken during processing so that the flour, bran and other milling products could be sampled along with the original wheat. The results of wheat and milling product analyses are shown graphically in Figure 1.[1] There are indications that the bran is highest in Sr^{90} and that at least a portion of the Sr^{90} is a surface deposit. The interpretation of these data is still open to some question since it is possible for a portion of the surface contamination to be transferred to the flour fraction. This will be discussed further, later in this report.

Material balances for calcium and for Sr^{90} were presented in Table X, page 33, Radiological Health Data, October 1960.[2] The values used in this table are averages of all 1958 data. The relative weight distribution of the milled fractions was obtained from a mill in Mandan, North Dakota and is assumed to be typical for the United States. Such a material balance is a good indicator of the validity of analytical data on milling products. The patent flour concentration is one-fifth of that in the original wheat.

Wheat analyses for the 1959 crop from several states are shown in Figure 2.[2] Additional material for 1959 is in process, and these data are needed before any comparison of 1958 with 1959 can be made.

To test the degree of removable surface contamination, a sample of Colorado wheat was water leached for two hours. From 6-8% of the Sr^{90} and 3-5% of the calcium was removed. This is an insignificant decontamination.

In Table 1 are shown the results of an experiment, conducted at the Health and Safety Laboratory, designed to estimate what fraction of the Sr^{90} found in wheat can be removed by stripping it[3] of the outermost layers of bran layer (beeswing). It is apparent that about 25% of the total Sr^{90} content of the wheat resides in the strippable beeswing fraction of the bran. The stripped beeswing is only about 4% of the weight of the wheat, while the bran is 11%. With a mean of 40% of the Sr^{90} in the bran, the beeswing is apparently more contaminated. The origin of this Sr^{90}, whether from foliar deposition or root uptake, is currently under investigation.

The relatively high levels of Sr^{90} in the bran portion of the wheat led to a series of analyses on bran products used as breakfast foods. Two such studies have been made. Data for the one by the Public Health Service were presented in Radiological Health Data, July 1960. page 97. The study by HASL is continuing and additional data will be published as soon as it becomes available.

The Public Health Service data show lower values than would be expected from 1958 and 1959 wheat analyses. Again, the representativeness of sampling should be considered in extrapolating to a national diet.

TABLE 1.--TEST OF SR^{90} REMOVAL BY STRIPPING OF WHEAT

Portion	Weight (kg)	$\mu\mu c\ Sr^{90}$ / kg	gm Ca / kg	Total	
				$\mu\mu c\ Sr^{90}$	gm of Ca
Hard red winter wheat	1.000	47.2	0.49	47.2	0.49
Stripped wheat	0.958	37.8	0.44	36.2	0.42
Beeswing stripped from wheat	0.042	302	1.65	12.7	0.07

[1]Reported in HASL-77 and HASL-84 and AEC Quarterly Statement on Fallout, April 28, 1960.
[2]Reported in HASL-84 and AEC Quarterly Statement on Fallout, April 28, 1960.
[3]The wheat was stripped for HASL by Mr. Theodore Earle using his patented process.

Figure 1 STRONTIUM^{90} IN 1958 WHEAT AND MILLING PRODUCTS

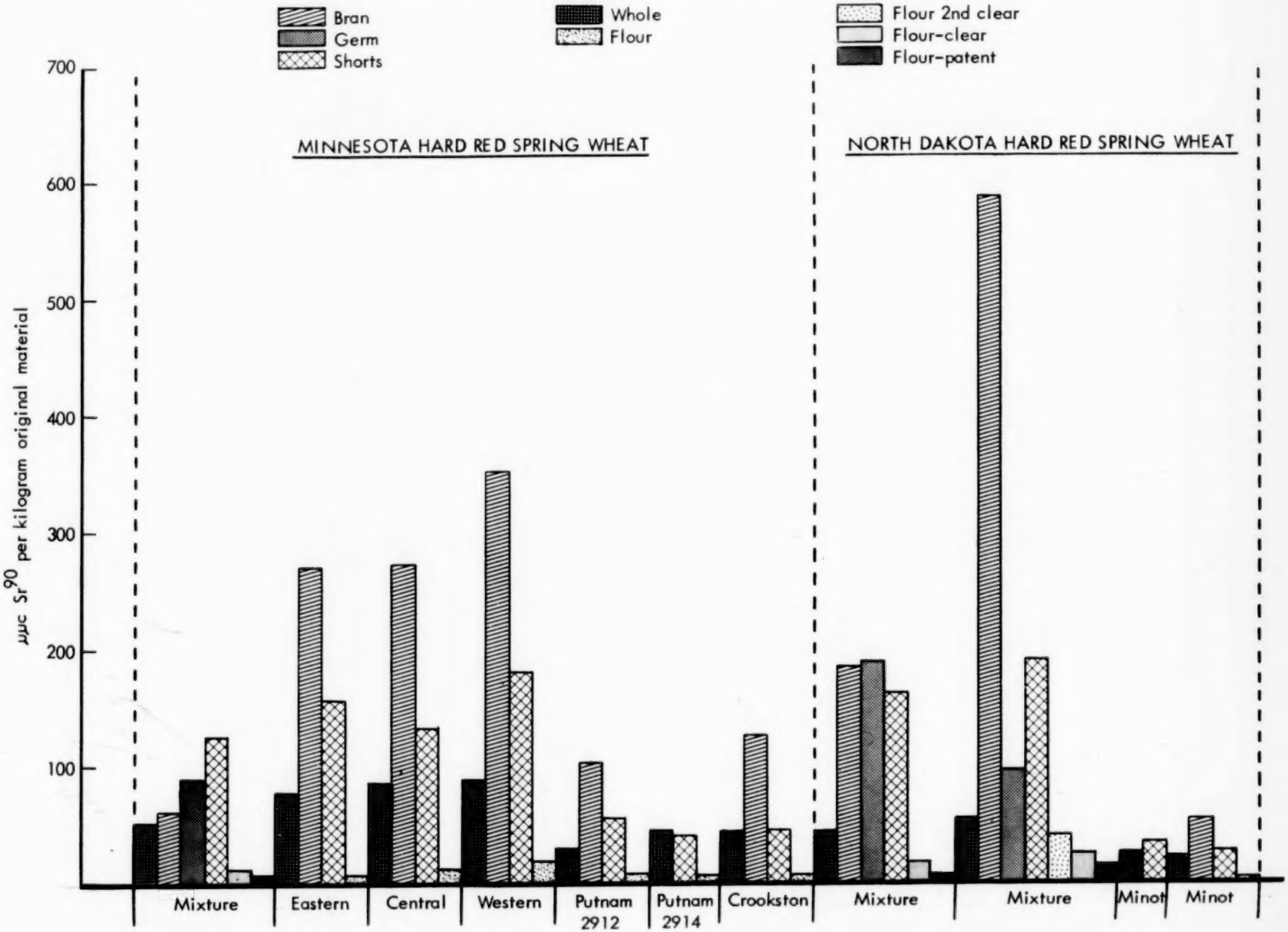


Figure 1 STRONTIUM^{90} IN 1958 WHEAT AND MILLING PRODUCTS

Figure 1. (cont.) STRONTIUM^{90} IN 1958 WHEAT AND MILLING PRODUCTS

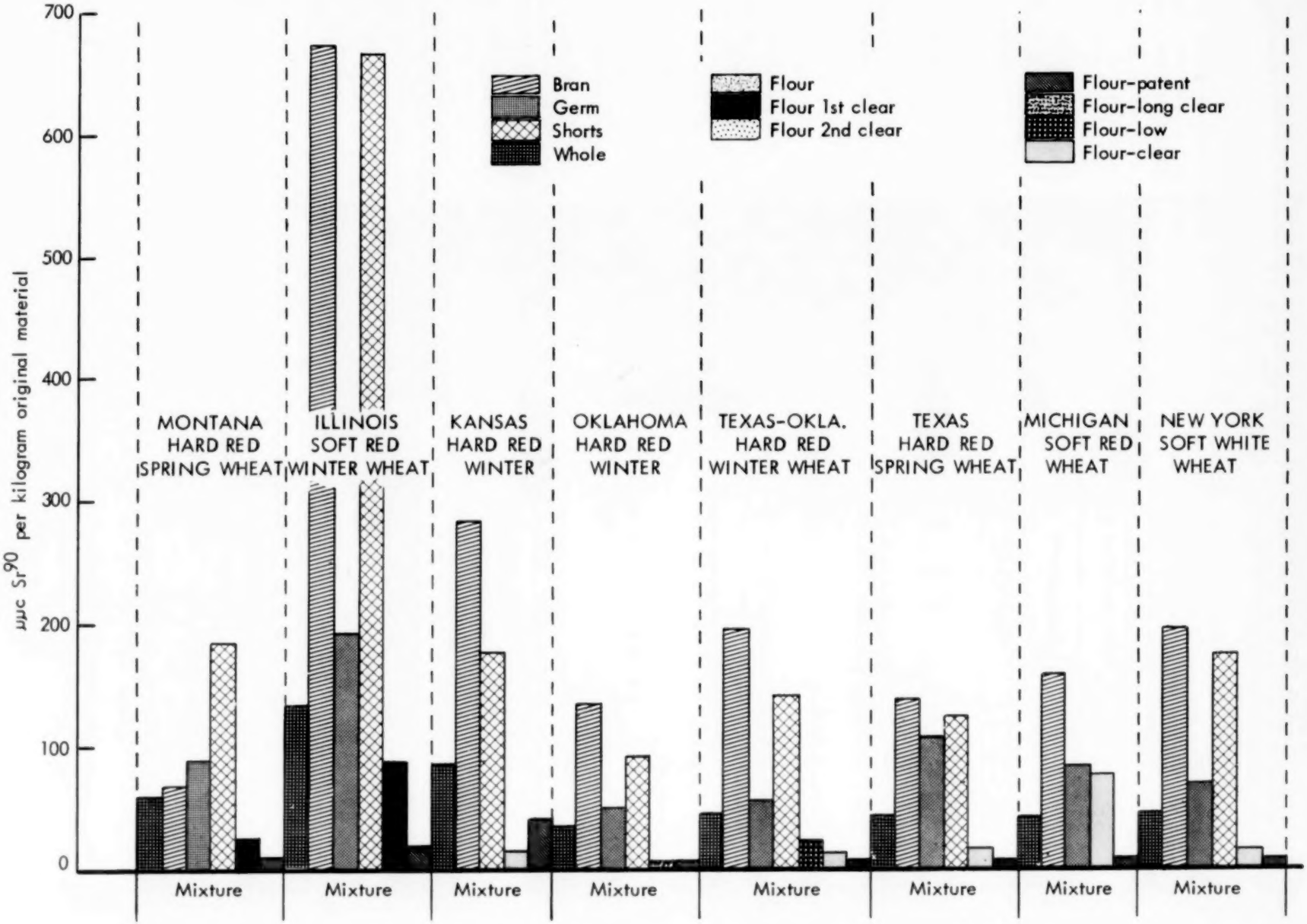


Figure 2. STRONTIUM^{90} IN 1959 WHEAT
Winter Wheat
Spring Wheat
MISSOURI
COLORADO
NEBRASKA
OHIO
IOWA
CALIFORNIA
μμc Sr^{90} per kilogram original material
0
20
40
60
80
100
120
140
160
180
200
Trenton
Sikeston
Pierce City
Columbia
Lamar
Brighton
Wray, Holyoke, Logan Co., NE., Julesburg
Burlington
Springfield, Springfield, S.E.
Alliance
N. Platte
Nemaha Co., Jefferson Co., Lancaster Co.
Carpenter
Croton
Cortland
Columbus
Wooster
Tiffin
Canfield
Lima
Castalia
Ripley
London
Ames
Clarinda
Kings Co., Joaquin Co.
Obispo Co., Sutter Co.

MONTEFIORE HOSPITAL METABOLIC STUDIES

U. S. Atomic Energy Commission

Certain special studies not aimed directly at obtaining diet information have been conducted that do provide some data. Doctors Herta Spencer and Joseph Samachson of Montefiore Hospital, New York City, have been conducting some valuable studies on calcium and strontium metabolism. Included in this work has been a measurement of diet and excreta of hospital personnel using current strontium-90 levels in food as a tracer. The diet information, based on an average of 5 subjects during 1959 as reported by AEC's Health and Safety Laboratory, is given in the following table.

TABLE 1.--DIETS OF HOSPITAL PERSONNEL

	kg/day	gmCa/day	$\mu\mu$c Sr^{90}/day
Milk	0.88	0.96	9.9
Non-Milk *	1.27	0.17	4.7
Total	2.15	1.13	14.6

Ratio: $\frac{14.6\ \mu\mu c\ Sr^{90}}{1.13\ gm\ Ca} = 12.9$

The non-milk component of the diet was planned to be low in calcium and consisted of the following in kilograms per day: flour and cereal 0.14, meat and fish, 0.36, potatoes 0.10 and fruits and vegetables, 0.67.

SHORT-TERM TRAINING IN RADIOLOGICAL HEALTH

Public Health Service

The Public Health Service through the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, routinely conducts short term training courses in Radiological Health for people from State and local health departments, other Federal agencies, industry and enrollees from other countries.

With increased use being made of radiation producing devices and other sources, it has become apparent that a need exists for qualified and trained personnel to evaluate potential radiation exposure in the field of public health. In an effort to cope with this problem the Public Health Service has instituted short-term courses for the purpose of familiarizing representatives of State and local health departments and other individuals charged with the responsibility of evaluating public health hazards. Since the program was launched, over 5,000 individuals have availed themselves of this professional training in all areas of public health activities. New developments in the nuclear field have been extremely rapid and the training affords an opportunity to minimize the time-lag between the development of new procedures and techniques and their application in assessing environmental exposure.

During the past year courses in 14 radiological health subjects were presented to 961 people. The following table outlines the type of courses, the number of times presented and the number of students taking each course.

TABLE 1.--TRAINING COURSES IN RADIOLOGICAL HEALTH CONDUCTED BY THE PUBLIC HEALTH SERVICE

Courses	Length (hours)	Number times given	Total enrollees
Courses Conducted at the Sanitary Engineering Center			
Radiological Health for X-Ray Technicians	40	1	29
Basic Radiological Health	80	6	206
Special Course for Deck Officers of the N.S. Savannah	40	1	22
Radionuclide Protection	40	1	20
X-Ray Protection	40	1	24
Medical Aspects of Radiological Health	80	1	24
Orientation in Radiological Health	80	1	46
Sanitary Engineering Aspects of Nuclear Energy	80	1	36
Reactor Environmental Health Problems	80	1	25
Radionuclides in Foods	80	2	48
Radionuclides in Water	40	1	28
Radioactive Pollutants in Air	40	1	13
Radioactive Pollutants in Water	40	1	33
Sub-Total (Resident)			554
Courses Conducted Away From the Sanitary Engineering Center			
Basic Radiological Health, Amherst, Massachusetts	80	1	33
Dental Radiological Health	8	8	356
Gadsen, Alabama			
Dothan, Alabama			
Decatur, Alabama			
Birmingham, Alabama (twice)			
Mobile, Alabama			
Tuscaloosa, Alabama			
Montgomery, Alabama			
X-Ray Protection New Brunswick, N. J.	80	1	18
Sub-Total (Field)			407
TOTAL			961

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